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Combined Arms Structured Simulation-Based Training Programs: Reflections of Key Developers

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14. ABSTRACT (Maximum 200 words):
A series of research and development programs on structured simulation-based training (SST) were conducted during the period 1993-1999. These programs focused on developing SST training support packages (TSPs) to meet collective training requirements for the combined arms at echelons of brigade and below. An SST development methodology was also produced. The purpose of the methodology was to support future TSP developments as requirements for them are identified. This report represents the second portion of a two-part examination of issues related to SST. The first report described the history of these programs and their lessons learned. This report presents findings in three areas which were either not directly addressed or insufficiently resolved in published SST reports. These areas are: the respective roles of the constructivism and behaviorism/Systems Approach to Training instructional theories in designing the SST TSPs; needs for additional information and SST-related research; and planning and logistical requirements for integrating and maintaining SST as a part of the U.S. Army training system. The information needed to address these three areas was obtained from structured interviews and questionnaires.

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Personnel Performance and Training

FOREWORD

Virtual and constructive simulation training systems have been increasingly used by the Army in an attempt to mitigate increasing resource constraints. The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has shown, however, that while these systems can be very effective, the extent of this effectiveness depends, in part, on how they are used. The ARI's Armored Forces Research Unit has conducted research and development efforts into structured simulation-based training (SST) in order to maximize the Army's ability to realize the training benefits offered by its simulation training systems. This effort has been directed towards collective training requirements of combined arms forces at echelons of brigade and below.

A companion report (Shlechter & Finley, [in preparation]) describes the history of the SST programs, and analyzes the SST instructional design processes, training products, and lessons learned as documented in published reports and training support packages (TSPs). The purpose was to make widely available the knowledge and insights gained from the SST programs. This report completes the effort. It draws upon interviews and questionnaires completed by key SST developers, providing important insights beyond those originally documented and illuminating actions necessary to make the use of SST TSPs a routine part of the Army's training practices.

This report was completed under the Armored Forces Research Unit's Work Package 205, Assessment of Force XXI Training Tools and Techniques (AFT3). The reviewed SST efforts were performed under two work packages: Strategies for Training and Assessing Armor Commanders' Performance with Devices and Simulations (STRONGARM) and Force XXI Training Methods and Strategies (FASTTRAIN). The research was completed pursuant to a Memorandum of Agreement with the U.S. Army Armor Center and Fort Knox: Manpower, Personnel and Training Research, Development, Test, and Evaluation for the Mounted Forces, 16 October 1995.

The information in this report has been provided to training developers and instructors at the U.S. Army's Armor School at Fort Knox. This report also has ramifications for the development and implementation of future SST programs.

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COMBINED ARMS STRUCTURED SIMULATION-BASED TRAINING PROGRAMS: REFLECTIONS OF KEY DEVELOPERS

EXECUTIVE SUMMARY

Research Requirement:

The Armored Forces Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) completed a series of structured simulation-based training (SST) research and development (R&D) programs during the period, 1993-1999. These programs focused on developing SST training support packages (TSPs) to meet collective training requirements for the combined arms at echelons of brigade and below. An SST development model/methodology had also been produced for use in addressing additional training needs as required. A companion report to this one (Shlechter & Finley, [in preparation]) provides an integrated history of these programs, and accrued lessons learned that can be applied to future SST TSP development efforts. In preparation for writing that report, the published SST reports and their TSP products were reviewed and analyzed, and discussed with others. Areas requiring further clarification and/or investigation were identified. These were: instructional design, remaining research needs, and implementation and fielding. This report addresses these three areas.

Procedure:

New and additional information was needed to address the three areas. Principal sources for this information were key developers who had participated in ARI's SST R&D programs. These persons included ARI's Contracting Officer's Representatives (CORs) and persons selected from the consortia of SST contractors. Upon request, these persons responded to structured interviews and questionnaires. These instruments were designed to gain information related to: personal backgrounds; experiences in the completed SST programs; and reflections and subsequent observations providing new insights and information.

Findings:

The findings addressed each of the three areas with respect to: the respective roles of the constructivism and behaviorism/Systems Approach to Training (SAT) instructional theories; specific needs for further information and research; and planning and logistical requirements for integrating and maintaining SST as a part of the U.S. Army training system.

The relative use of the two instructional theories was examined across the SST R&D programs. The SST programs differed along two major dimensions: the echelons and the types of tasks

being trained. It was found that selections of elements from each of the two theories varied in a consistent manner across ARI's SST programs, even though behaviorism/SAT elements predominated in every case. The change was a transition towards greater use of constructivism in those SST programs focusing on the higher echelons, and on command and battle staff (as opposed to combat) types of tasks. The choices of design elements by the key developers were found to have been based primarily on examination of the specifics of each training requirement. The results were hybrid applications of the two theories in every case.

Needs for front end analyses (FEAs), research, and enhancements to the SST development model were well specified. The FEAs were seen as an effective way to gain needed information. The information would especially be used as a basis for determining how to best integrate SST into the U.S. Army training system and as a means for evaluating possibilities for more efficient training. The needs identified for research primarily concerned transfer of training issues. These issues related not only to SST, but also to simulation-based training in general. A singular effort was suggested to enhance the SST development model, one to improve those software capabilities needed to implement the structures designed for the TSP scenarios and subsequent modifications to them.

Finally, based on comments regarding the considerable potential for SST benefits and concerning needs for sustainment and support if these benefits are to be realized, certain actions were proposed. These actions are intended to satisfy SST sustainment and support requirements in a manner assuring realization of the SST training benefits. These proposed actions include development, enactment, and implementation of: an Army SST Master Plan, an SST logistics system, and attendant policies.

Utilization of Findings:

The companion report (Shlechter & Finley, [in preparation]) that stimulated this investigation has ramifications for both the military training and instructional design communities. Both communities should be able to use that report as a building block for future SST efforts. This report provides new information that complements the companion report for both communities. In addition, research issues are discussed that would interest instructional theorists and researchers. Lastly, this report offers recommendations for actions that should especially benefit military training implementers, users, and managers, and those logisticians with training-related concerns.

COMBINED ARMS STRUCTURED SIMULATION-BASED TRAINING PROGRAMS: REFLECTIONS OF KEY DEVELOPERS

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COMBINED ARMS STRUCTURED SIMULATION-BASED TRAINING PROGRAMS: REFLECTIONS OF KEY DEVELOPERS

INTRODUCTION

This report represents the second portion of a two-part examination of issues related to structured simulation-based training (SST). A companion report (Shlechter & Finley, [in preparation]) provides a detailed description of research and development (R&D) programs executed to produce SST for the U.S. Army. These programs focused on collective training requirements for the combined arms at echelons of brigade and below; all were executed under the direction of the Armored Forces Research Unit, located at Fort Knox, KY, an element of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI).

The companion report focuses on the documented SST R&D history, products (i.e., training support packages, or TSPs), and lessons learned. Based on review and analyses of this documentation, a total of 43 lessons learned were identified. These lessons were intended to support future efforts initiated to develop SST TSPs. One such lesson learned, especially relevant to this report, was that future SST efforts should probably take a hybrid approach to the application of instructional design concepts.

The companion report also provides an integrated overview of ARI's SST R&D programs. The integration encompassed a very large number of very substantial documents. The report should therefore provide not only an overall perspective, but also serve as a guide for those wishing to determine which documents would best serve them when addressing more detailed questions.

Based on reviews and analyses of the documentation, it appeared that one or more issues could benefit from a closer examination. For example, even though the use of a hybrid SST design approach was apparent based on the documentation, the reasons for a hybrid approach or the exact constitution of that approach were not clear. Moreover, discussions participated in while preparing the companion report suggested that some valuable new insights may have evolved based on retrospection and subsequent observations. A second report on SST appeared to be warranted. Emerging topic areas appeared to be instructional design, SST implementation and fielding, and remaining SST research needs.

Given the foregoing, efforts to collect additional information were initiated and this report is the result. The principal sources for this information were those personnel directly involved in ARI's SST R&D programs. Ones identified as especially key persons did, upon request, provide the necessary information. These key program participants included ARI's

Contracting Officer's Representatives (CORs) and those persons they selected from their consortia of SST contractors. The CORs and selected contractors are referred to throughout this report as "key developers." They provided the information sought by responding to questionnaires and structured interviews.

This report describes the findings and the collected data found to be most relevant. The findings cluster into three major areas. These areas are:

- Contributions of the constructivism and behaviorism instructional theories to the SST programs;
- Needs for further information and research; and
- Planning and logistical requirements for integrating SST into the Army's training system.

The likely target audiences for these three areas are: training and instructional developers, researchers, and theorists; training implementers, users, and managers; and logisticians with training-related responsibilities.

The report is divided into six sections. First, a Background section presents a brief history of the SST programs, a description of the targeted training participants and the key developers, and the rationales and issues guiding preparation of this report. The next section describes the methods used to collect and analyze the data. The findings, or Results, are presented in three sections aligned with the areas listed above. The report closes with a Summary and Conclusions section.

BACKGROUND

A Brief History of the SST R&D Programs

Need for SST R&D

Simulations as a training capability. During the last decade, there has been a reduction in the U.S. Army's fiscal allocations for such personnel as instructors, unit trainers, and training developers (Department of the Army [DA], 1999). There has also been a sharp reduction in fiscal allocations for training supplies such as ammunition and fuel. Training resources have always been limited. They have become even more limited in recent years.

To meet this resource challenge, the U.S. military has increasingly relied on virtual and constructive simulation-based systems to provide training to its combat forces. These simulation systems are less resource-intensive than traditional military field exercises, or "live" simulations. Virtual systems involve immersing the training audience into tactical situations where direct contact with conditions on the battlefield itself are closely approximated (e.g., sitting in a simulated tank while viewing simulated terrain and enemy tanks). Constructive simulations provide training participants with tactical scenarios through use of computer-driven models of the battlefield. Here, the interfaces with the battlefield are more indirect and much like what would be experienced in a command post (e.g., computer-driven displays of changing data and of icons representing enemy units on maps). Over the years, many virtual and constructive simulation systems have been demonstrated to be capable of training effectively (e.g., Finley, Rheinlander, Sullivan, & Thompson, 1971; Bessemer, 1991).

The virtual systems for the SST programs are the Simulation Network (SIMNET) and the Close Combat Tactical Trainer (CCTT) systems. The constructive systems are the Janus and Brigade/Battalion Battle Simulation (BBS) systems. Another system used in the SST programs, the Staff Group Trainer (SGT), can be described as a hybrid virtual-constructive system. A factor differentiating these systems is the extent to which they provide the types of realism found in a real-world situation. This factor depends on the number of real-life variables that can be simulated with apparent face-validity. The CCTT is able to replicate more variables than the older SIMNET. The same is true for the BBS when compared to Janus. (In both cases, there is also a differentiating factor of replication scope, but this factor is not a major concern for this report.)

A structured approach to simulation-based training: A definition. An approach of structuring training such that it more or less focuses on achievement of specified training objectives has often been acknowledged as essential to the achievement of efficient and effective training (e.g., Joint Simulation System (JSIMS) Learning Methodology Working Group, 1999). In developing structured strategies tailored to the environment afforded by simulation-based training systems, ARI's SST R&D programs have defined the key elements to be (Campbell, Campbell, Sanders, & Flynn, 1995; Campbell & Deter, 1997):

- Training exercises are designed to embed specified training objectives into a predetermined, well detailed, scenario.
- That scenario is designed to provide cues, or triggering events, for the training participants.
- These cues are intended to cause the participants to perform the desired behaviors and then experience the consequences of their actions.

Problem: Failure to sufficiently realize potential training benefits. Many simulation systems have been fielded without standardized training programs. Unfortunately, even where standardized programs have been made available, many of these have not been intentionally structured as needed to meet well-specified training requirements. The fielding of SIMNET was one example of no standardized training programs being available, let alone structured. Here, decisions regarding which SIMNET battlefield environment to request, which mission to execute, and specification of the scenario details were considered to be the responsibility of the unit requesting the training. Hence, realization of SIMNET's training potential depended on qualifications of the unit's personnel: their knowledge of SIMNET's simulation capabilities and limitations, their having adequately specified their training needs beforehand, and their understanding of how to relate SIMNET's capabilities to their needs. The SIMNET site staff would assist the unit, but this was difficult when the unit's training objectives often were not well articulated. Under these conditions, exercises often evolved into ones that were largely free-play and, upon completion, it was not clear what, if any, training needs had been met.

To the extent a unit was able, however, to specify its requirements and did so within the perceived SIMNET environment, the unit imposed at least some structure on their simulation-based training; that is, they were accomplishing SST to some degree at least. A corollary to the foregoing observation is that such a unit would also avoid using simulation systems like SIMNET in a completely free-play mode because they would understand, whether or not explicitly, that free-play was the antithesis of the structure they needed to achieve their training objectives.

However, the expertise found to exist in units regarding how to specify training needs and then relate these to simulation system capabilities is generally limited. It is not surprising that Bessemer (1991) determined that the training needs met and the effectiveness of SIMNET in meeting these needs varied from training unit to training unit. These variations were found to be due largely to the foregoing limitations. Another constraint in exploiting Army simulation-based training systems, in addition to not always using simulation systems to their best advantage, was that many units spent considerable time specifying their exercises at training sites after they arrived - rather than using their precious and limited time to actually train (Shlechter, Bessemer, Nesselroade, & Anthony, 1995).

<u>SST R&D in response to the problem</u>. In light of the foregoing, the ARI SST programs were R&D efforts directed toward enabling the Army to better exploit their simulation-based training systems. They involved the development of procedures to create standardized structured training exercises, each serving a particular mix of clearly identified training requirements. In so doing, ARI also created some initial sets of these SST exercises (i.e., TSPs). Given the availability of these standardized SST exercises, units could then select those

which best met their training needs. Further, units could do this prior to their arrival, thus freeing up time for training at the simulation system's site.

The particular set of training requirement(s) addressed by each individual TSP produced under ARI's SST program was determined largely by the primary focus of each SST project. An overall description of the training requirement(s) and audience(s) addressed across the SST TSPs is provided by considering the five factors listed below. The general requirements addressed by a specific SST TSP can be described by selecting, as appropriate, one or more of the options listed with each of the factors:

- Task areas: Combat, and Command and Battle Staff;
- Missions: Movement to Contact, Defense, and Deliberate Attack;
- Mission phases: Plan, Prepare, and Execute (in some cases, the Execution elements of consolidation and reorganization were included);
- Echelons: Platoon, Company/Troop, Battalion, and Brigade/Brigade Combat Team; and
- Branches: Armor, Cavalry, Infantry, and those branches appropriate for selected Combat Support (CS) and Combat Service Support (CSS) roles (e.g., Signal, Engineer).

A Snapshot of the SST Projects

A total of ten projects were performed under ARI's SST R&D program. These ten projects will be considered in this report to group into four sets of projects. These four sets will generally be designated as "programs," which, together, constitute the overall ARI SST R&D program. The four sets of projects are:

- The Virtual Training Program (VTP), which was developed during fiscal years 1993 through 1996. For the purposes of this report, VTP includes three projects: Simulation-based Multi-echelon Training Program for Armor Units (SIMUTA), SIMUTA-Battalion Exercise Expansion (SIMUTA-B), and Simulation-Based Mounted Brigade Training Program (SIMBART).
- Structured Training for the Close Combat Tactical Trainer (STRUCCTT), which occurred during fiscal years 1997 through 1999.
- Staff Group Trainer (SGT), which transpired during fiscal years 1997 through 1998.

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- Structured Training for the Close Combat Tactical Trainer (STRUCCTT), which occurred during fiscal years 1997 through 1999.
- Staff Group Trainer (SGT), which transpired during fiscal years 1997 through 1998.

- Combined Arms Operations at Brigade Level, Realistically Achieved through Simulation (COBRAS), which took place during fiscal years 1995 through 1998.

Special designated congressional funds were used to initiate the SIMUTA and COBRAS R&D efforts.

The "VTP" designation covers all SIMUTA and SIMBART efforts in this report because of the manner in which questionnaire and interview items were constructed and then discussed with the key developers. Where STRUCCTT is the sole topic or is a referent in a discussion along with VTP, the respective designations of either STRUCCTT or VTP/STRUCCTT will be used.

Figures 1a and 1b describe the alignment of the four programs with the five factors listed above that can be used to characterize the many training requirements addressed: tasks, missions, mission phases, echelons, and branches. The programs are aligned with their approximate program execution timelines. If further details are desired, see Shlechter and Finley (in preparation).

Targeted Training Participants

The targeted training participants for these R&D efforts were combined arms soldiers. The central focus was on the combat arms branches of Armor, Cavalry, and (mechanized) Infantry. Specific training objectives for selected CS and CSS functions were introduced in the SGT and COBRAS programs. This led to members of branches appropriate to those roles (e.g., Signal, Engineer) becoming major training participants as well, rather than acting only as role players when necessary.

The "Key Developers"

Many military, civilian government, and civilian contractor personnel participated in the SST R&D efforts. Persons from the latter two groups constituted the "key developers" who contributed the "reflections" documented in this report.

Civilian government group. The contributing members of the civilian government group were the two SST R&D Contracting Officer's Representatives (CORs). These CORs formulated and designed the programs, and were responsible for both guiding the programs technically and monitoring performance from a contractual standpoint. They provided interpretations of the Army's interests, needs, and circumstances to the contractors, as well as their own technical expertise. Familiarity with the problem area included their experience as Army officers and as CORs for other training R&D efforts.

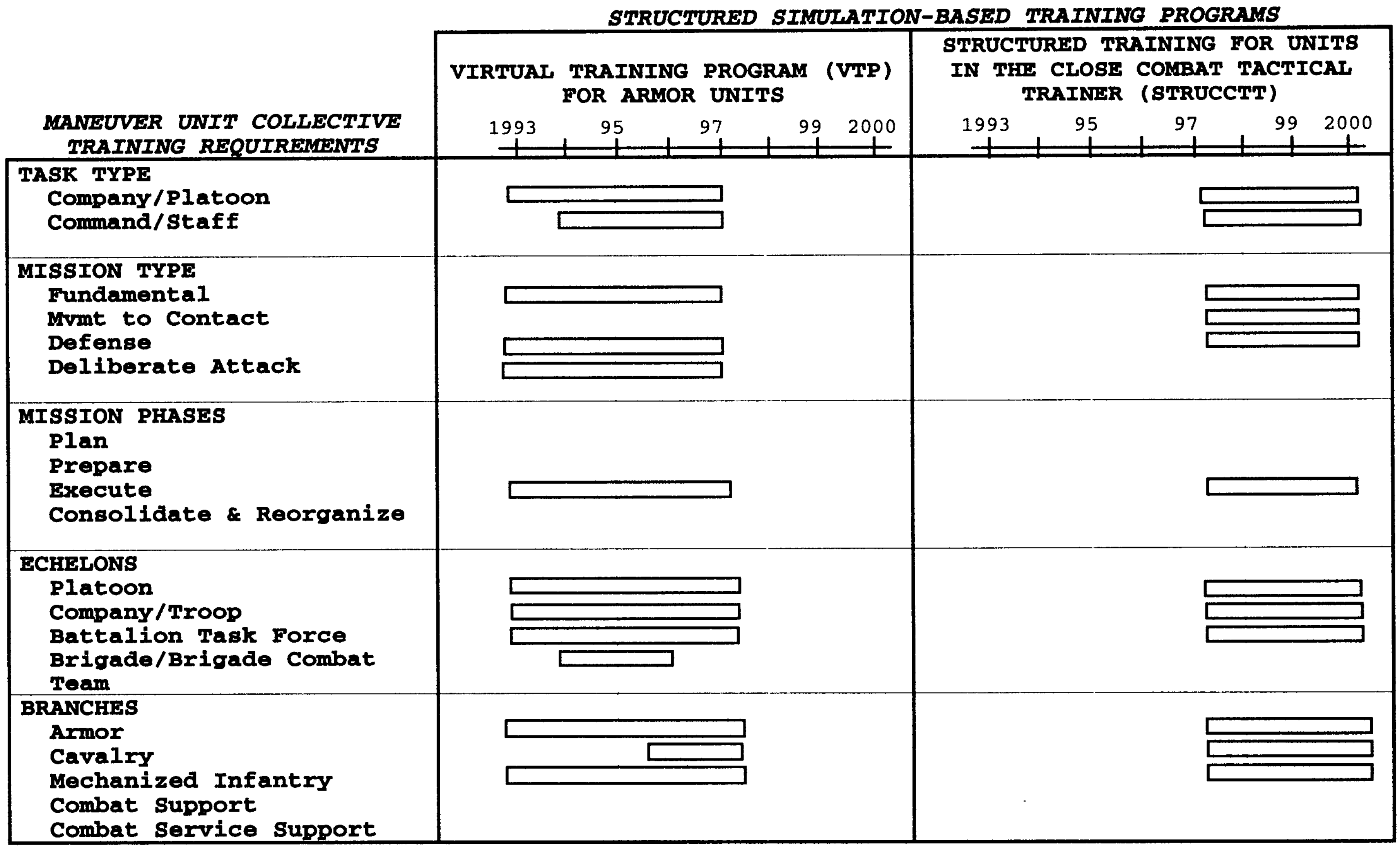

Figure 1a. Approximate time line of the VTP and STRUCCTT sets of SST programs in response to maneuver unit collective training requirements.

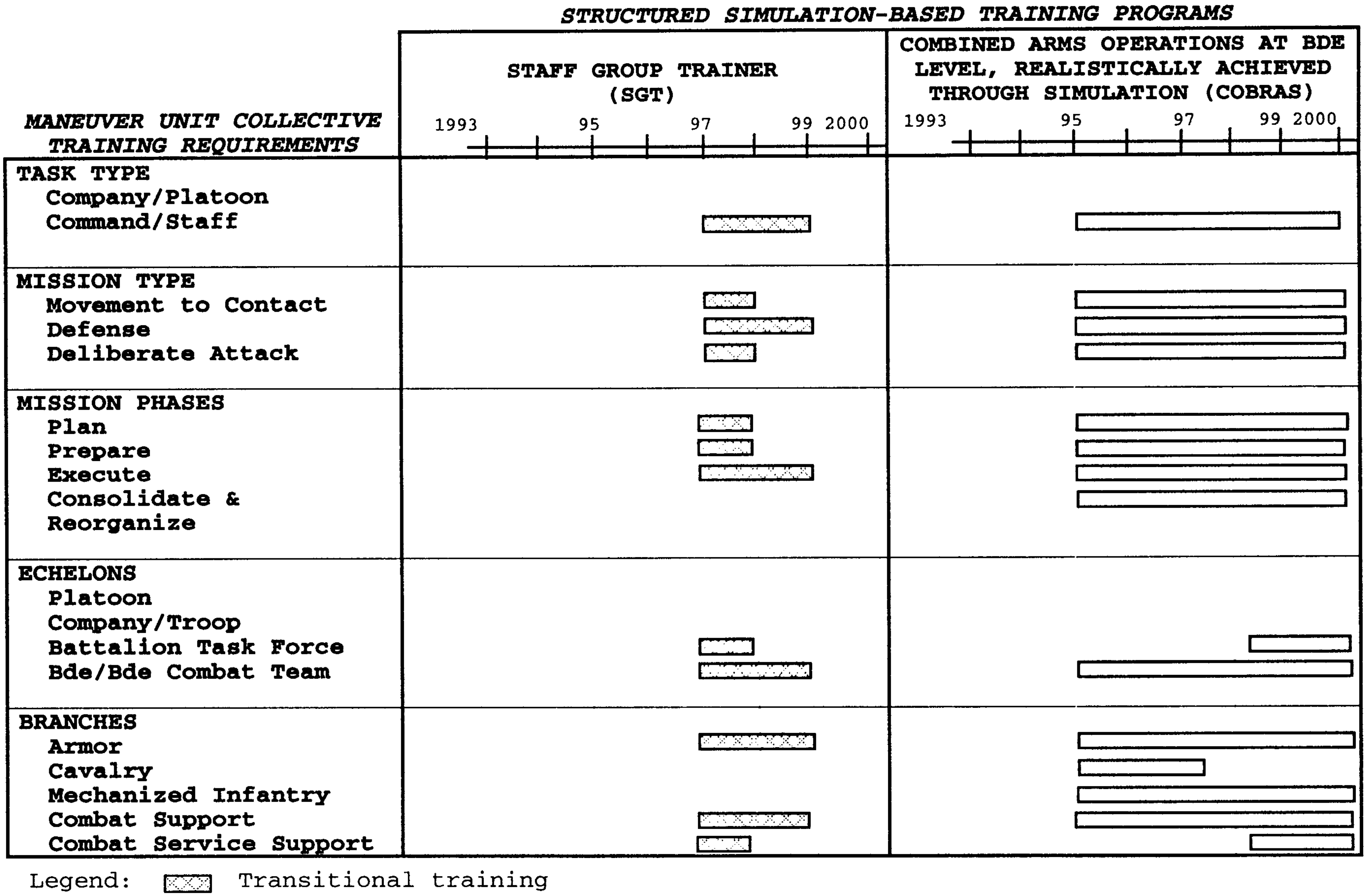

Figure 1b. Approximate time line of the SGT and COBRAS sets of SST programs in response to maneuver unit collective training requirements.

Civilian contractor group. The civilian contractors molded, developed, and implemented (during initial tryouts) the SST TSPs in response to the CORs' guidance. The CORs selected 15 of these persons to represent the consortia of SST contractors for the present information collection effort. These persons, as a group, provided a representative sample of experience across the SST programs and were persons who also served in especially important roles. This contractor group was comprised of SST program leaders and technical personnel having expertise as instructional designers, evaluators, technicians, and users, as well as expert knowledge regarding military perspectives. The contractors selected were ones who had experienced an intense program involvement of relatively long duration. Many of them also had experience in more than one role and on more than one program.

More detailed information was obtained on the contractors' prior experience, and their roles and responsibilities on the SST programs, through use of a questionnaire (see Appendix A, Part A). While the questionnaire itself will be described in the Method section, the data obtained on selected items are presented below. The purpose is to provide the reader with a quantitative understanding of the composition of the contractor group in terms of types of prior experience, and roles and experiences in the different SST programs and projects. This information is presented now to avoid distracting later discussions of findings from the points being made.

These background data provide a picture of the contractor key developers particularly useful for appreciating the knowledge base from which they spoke. Responses described the contractors' training-related experiences prior to working on ARI's SST programs, number of years involved in ARI's programs, and the ARI SST programs on which they worked. These responses are tabulated in Table 1. With regard to prior experience, all participants, with the exception of one, indicated having had three or more of the experiences listed in Table 1. All indicated that they had worked on ARI's SST programs for at least two years, while 60% indicated they had worked on them for five or more years.

Data presented in Table 1 describing participation in the SST programs makes it clear that many of the contractors worked on more than one program (12 + 7 + 8 does not equal 15). To clarify the picture of involvements in SST programs, a Venn diagram depiction is provided in Figure 2. It can be seen from this figure that only four contractors worked on only one group of SST programs. Of these four, two worked exclusively on VTP/STRUCCTT, while the other two worked exclusively on COBRAS. It can also be seen that only one contractor worked on all three program groups.

Table 1. Data describing the contractors' prior experiences and involvement in the SST R&D programs.

BACKGROUND AND PROGRAM INVOLVEMENT OF THE CONTRACTOR KEY DEVELOPERS (QUESTIONNAIRE ITEMS 1 - 3)	FREQUENCIES & PROPORTIONS N = 15
HAD THESE PRIOR RELATED EXPERIENCES (Q1)	
Student/trainee in a military instructional program	10 **(.67)**
Member of a military instructional team	12 **(.80)**
Instructional designer	10 **(.67)**
Member of a program's evaluation team	8 **(.53)**
Student/trainee in a civilian instructional program	10 **(.67)**
Something other than the roles described above	4 **(.27)**
None of the above - this is my first experience	1 **(.07)**
INVOLVED IN THE ARI SST R&D FOR HOW LONG (Q2)	
Five or more years	9 **(.60)**
Two - four years	6 **(.40)**
One year or less	-
PARTICIPATED IN THESE SST R&D PROGRAMS (Q3)	
VTP/STRUCCTT	12 **(.80)**
SGT	7 **(.47)**
COBRAS	8 **(.53)**

Rationales and Issues Guiding this Report

As indicated in the Introduction, the information obtained for this report fell into three areas: the contributions of the constructivism and behaviorism instructional theories to the SST programs; needs for further information and research; and planning and logistics requirements for SST. As the importance of the second and third areas should be obvious, no underlying rationales and issues will be discussed here. In contrast, while issues surrounding alternative instructional theories and development of many types of instructional programs, including SST TSPs, are important, they are not always appreciated or addressed as a part of development. Therefore, discussion of

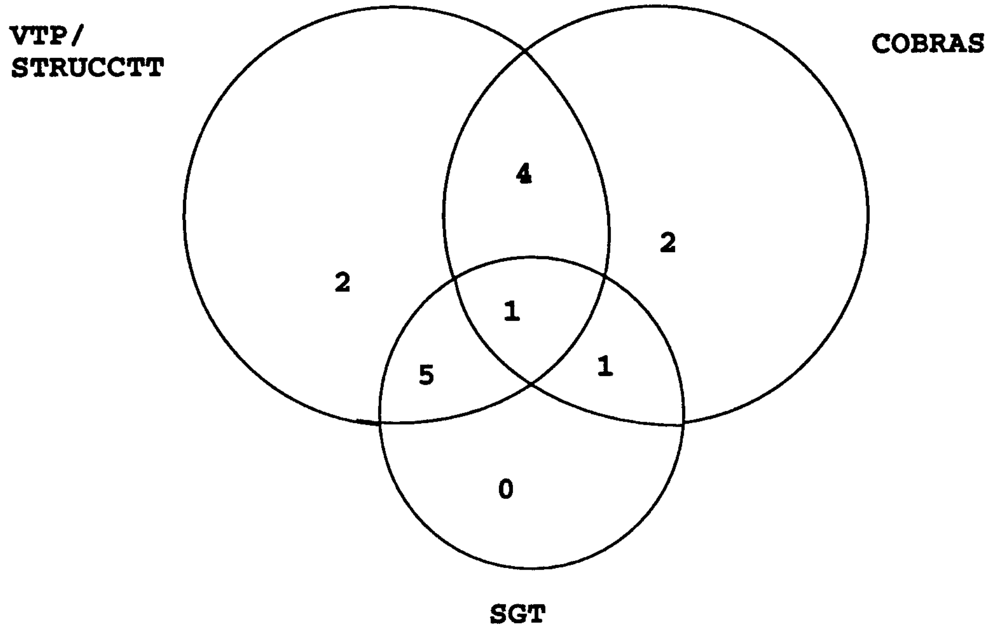

Figure 2. SST program experiences of the 15 questionnaire respondents.

the background and rationale for addressing this issue is presented here.

During the period of the SST R&D, 1993-1999, a newer instructional theory, called constructivism, was gaining the spotlight and being compared to traditional behavioristic approaches (cf., The Cognition and Technology Group at Vanderbilt, 1992; Duffy & Jonassen, 1992; Willis, 1995). Behavioristic approaches were best known to the military, as well as in many other circles, as those procedures constituting the Systems Approach to Training and Instructional Systems Development (SAT, ISD, or SAT/ISD). The labels, SAT and ISD, have been institutionalized through documentation (e.g., Branson, 1978; Branson & Grow, 1987), common use, and regulations governing their use (e.g., Department of the Air Force, 1970; DA, 1995; Department of the Navy, 1981). Major differences between the approaches of constructivism and behaviorism are described in Table 2 with regard to instructional emphases.

Table 2. Instructional emphases of the constructivism and behaviorism theories.

INSTRUCTIONAL EMPHASES	
CONSTRUCTIVISM	BEHAVIORISM
Instructional objectives emerge from decisions made by the training participants.	Instructional objectives are determined by analysts before training is provided.
Authentic instructional conditions.	Instructional objectives are the fulcra for developing the instructional materials.
Training participants develop an understanding of the principles of tactics.	Training participants learn how to execute tactical actions.
After action reviews (AARs) are led by the students.	AARs are led by the instructors.

Based on evidence drawn from analyses of the TSPs and discussions with the CORs, Shlechter and Finley (in preparation) observed that "SST programs should seemingly be a hybrid of the behavioral and constructivist approaches to instructional design." (p. 99). Shlechter and Finley were not, however, able to delineate the contributions of the two approaches to the degree desired.

The published SST reports generally described procedural aspects of the SST TSP development and instructional methods, often to a fairly detailed level. This was *apropos*, given the R&D goal to provide the U.S. Army with not only a working sample of TSPs, but also a methodology for developing additional ones in the future. The reports did not, however, provide explicit discussions of alternative instructional theories and approaches shaping these procedures. Rather, the reports pointed to SAT as being their basis and then described those procedural changes made to SAT when needed to better address changes taking place in the instructional requirements. (These changes in requirements resulted from changes in the training audiences from combat units at platoon and company echelons to command and battle staffs at battalion and brigade echelons [see Figures 1a and 1b].)

From the standpoint of instructional theory and design, the changes appeared to reflect at least some movement from traditional behaviorism, or SAT/ISD, to the newer constructivism approach. However, lacking articulation in the reports of the analysis and methodological changes from the perspective of SAT/behaviorism and constructivism features, it was not clear whether these alternative instructional design approaches had been explicitly examined or not.

From ARI's perspectives, the research and utilitarian ones, the application of alternative instructional theories to SST and the reasons for choosing one theory as compared to the other are important. On occasion, past comparisons between constructivism and SAT/ISD approaches have been presented as oppositional rather than addressing how to make the best selections of their respective features. We suspect that an oppositional view may not always be in the best interests of meeting training needs. It may rather be the case that a better course of action would be to consider alternative instructional concepts and to do so in terms of any special aspects of the training requirements.

At least one effort is known which did take this approach. That effort explicitly examined alternative instructional theories, including constructivism and behaviorism, to identify features best suited to a particular training need associated with the U.S. Field Artillery Officer Advanced Course (FAOAC) (Ross & Pierce, draft 1998). The authors described their results as a framework, or strategy, which drew from features of each theory as was deemed most appropriate for meeting the specific instructional requirements and conditions of FAOAC.

The ARI SST R&D program offers an opportunity to move a step beyond Ross and Pierce's work (draft 1998), where only one course of instruction was examined. The overall ARI program can be separated into two, three, or four programs, depending on which distinctions are useful for the discussion at hand: VTP/STRUCCTT and SGT/COBRAS. As there are some major differences in the training requirements addressed across these SST programs, differences found between them with regard to instructional design could be of interest. If any of these differences could be described as reflecting choices between constructivism and behaviorism, this would be of interest from a research standpoint. From the standpoint of instructional development, this could serve utilitarian purposes as well.

METHOD

Research Approach

The approach consisted of obtaining information from the two groups constituting the key developers: the SST R&D CORs (N = 2) and selected contractor personnel (N = 15). These 17 persons were described in the Background section and noted to be the "key developers" referenced in the title of this report.

Both questionnaire and interview formats were used and are described below. The same interview team of two persons conducted all data collection sessions.

Only interview data were obtained from the CORs. Both interview and questionnaire data were obtained from the contractors. The contractors, on an individual basis, each completed a self-administered questionnaire and an interview within a single session. During this session, they completed the questionnaire first, in about 30 minutes, and then the interview, in about 90 minutes.

Questionnaire Method

The questionnaire instrument contained three sections (see Appendix A):

- Demographic information. The first section of the questionnaire obtained background information on the contractor personnel regarding their prior experience, and their roles and responsibilities on the SST programs. The collected data were presented earlier in the Background section.

- Overview items. This section consisted of two parts, A and B, VTP/STRUCCTT and COBRAS/SGT, respectively. Each contained identical items dealing with different aspects of the programs. The contractor personnel were instructed to address Parts A and/or B in accordance with those programs in which they had been involved. Those addressing Part B who had been involved in both the COBRAS and SGT programs were instructed to enter comments differentiating between these where appropriate.

- Constructivism and behaviorism. This section was also comprised of parts A and B, VTP/STRUCCTT and COBRAS/SGT, respectively. Parts A and B each contained the same two groups of items. The first group described elements of constructivism, while the second group described elements of behaviorism. The participants were instructed to check all of the elements, constructivistic and/or behavioristic, they felt represented a pervasive characteristic of the programs on which they had worked. The constructivistic and behavioristic elements presented in the questionnaire were based on a review of the literature. Sources for these elements are cited in Shlechter and Finley (in preparation).

Interview Method

The instruments and data collection procedures for the CORs and contractors were much the same. The few differences are described.

The CORs

Interviews with the CORs were conducted first and were exploratory in nature. Each COR was individually interviewed several times, with each interview lasting between one and two hours. The interviews were loosely structured vis-à-vis the protocols presented in Appendix B. Topics discussed during the COR interviews included:

- History or background of the training programs.
- Goals of the training programs.
- Instructional design.
- Implementation concerns.
- Lessons learned.
- Contributions made to the military training community.
- Future R&D efforts.

The Contractors

The interviews conducted subsequently with the contractors drew upon information gained from the CORs. The structured interview form, provided in Appendix C, contained nine items. The first item was a follow-up question asked regarding any questionnaire items where the respondent's answers appeared unclear or incomplete. Upon completion of this initial phase of each interview, the interview team then asked participants to discuss and offer their opinions on the remaining items contained in the structured interview form. The remaining questions probed such issues as:

- similarities and differences between the VTP/STRUCCTT and COBRAS/SGT sets of programs (asked only of those respondents who had worked on one or more projects in both sets);
- lessons learned from these programs;
- contributions made by these programs to the military training community; and
- future R&D efforts needed to improve these programs.

In each case, the same member of the interview team asked the questions and took some notes. The other interviewer always took detailed notes. Both interviewers asked participants to elaborate upon any of their comments suggesting additional insights or requiring further explanation. The only interview tape-recorded was the first one. This experience provided evidence that tape-recording was not necessary.

Scoring Procedures and Data Analyses

The interview data were scored and analyzed using the following scheme:

- Transcriptions. The person taking the detailed notes transcribed the participants' comments. The transcriptions were then reviewed and any discrepancies between the transcriptions and the other set of notes were resolved.

- Content analyses. The transcribed interview data were then organized into content categories based on previous discussions between the authors, and topic areas suggested by the interview questions and responses. Also sorted into these categories were comments written by the respondents on their questionnaire forms and their responses to the initial follow-up queries. The data were coded in order to protect the respondents' privacy and confidentiality. The content categories and that organization of the interview data were not directly used in presenting the findings in this report. However, this exercise greatly facilitated subsequent discussions and decisions regarding how the interview responses should be organized.

Data Presentation

As a part of above process, two rules were developed concerning how the interview data would be treated and presented. These were:

- Presentation of the interview data would be descriptive in nature, but not to the extent of descriptive statistics.

- The discussion, in all cases, would focus on the most salient trends and comments.

There were several reasons for these two rules. While the interviews were structured, the questions concerned complex topics where: (1) any number of different aspects could be and were addressed on each topic; and (2) the respondents differed from each other with regard to the mix of programs on which they had worked (see Figure 2), and their individual mix of activities, vantage points, and types of expertise. Hence, there was generally not enough commonality between the aspects addressed or response contents to allow meaningful quantification of responses across the key developers. The interviews led to an enormous number of very informative and insightful comments, but many of these were also one of a kind.

Where the contractor and the COR key developers addressed the same topics and their responses indicated similar perspectives, their comments have been integrated. Where, however, the CORs or contractors addressed different topics or offered comments reflecting differing perspectives, these data are presented separately. The COR and contractor key developers shared considerable experience and knowledge but there were some notable differences between them. The contractor personnel had the closer day-by-day technical experiences. The CORs had the programmatic, managerial, Army, and R&D perspectives corresponding to their positions and responsibilities.

RESULTS: USE OF THE CONSTRUCTIVISM AND BEHAVIORISM APPROACHES FOR SST

It was stated in the "Rationale" section of the Background that, rather than adopting an oppositional position with regard to constructivism and behaviorism, it may be better to examine both and to do this in terms of specific training requirements. It was further noted that the overall ARI SST R&D program could be examined as two, three, or four programs (VTP/STRUCCTT, SGT/COBRAS). As there are some major differences in the training requirements addressed across these SST programs, any differences between them regarding instructional design approaches would be of interest. If these differences seemed to also reflect differences between constructivism and behaviorism, this would be especially interesting.

Similarities and differences were described between the SST programs during the interviews with the contractor key developers (items B.1 and B.2, Appendix C). These similarities and differences between the SST programs are presented first to provide background information. This will be followed by presentation of the questionnaire responses describing the use of constructivism and behaviorism elements across the SST programs (Appendix A, Part C).

SST program similarities and differences were addressed by those contractors who had worked on more than one program (N = 11; see Figure 2). Data describing the application of constructivism and behaviorism elements to the SST programs were provided by all 15 contractors, but only for those programs on which they had worked.

Background

Similarities across the SST Programs (Interview Item B.1)

The majority of respondents, whatever the combination of programs on which they had worked, pointed to the TSP products as being the desired end product across all programs. The respondents identified these similarities with respect to TSPs:

- training strategy;

- development procedures;
- layout; and
- content.

Training strategy. Elements of strategy included:

- All programs focused on determining the training objectives first, and then structuring and designing TSPs to achieve these objectives.
- Guidance and tools were provided to encourage provision of performance feedback (i.e., AARs) pertaining to these objectives.
- To the extent possible, a "crawl-walk-run" (c-w-r) approach was taken. (This training model is used extensively in the U.S. Army. In the SST case, it was the intentional design of TSPs to match the skill levels of training audiences ranging from novice to more expert.)
- While the emphasis differed across programs, the focus overall was more on process than on mission outcome.

Development procedures. While some additional procedures and information were needed for COBRAS, SAT provided the foundation throughout. The design of the scenarios was structured to cause particular events to happen, thereby setting the stage for achieving the intended training objectives.

Layout. Separate sections were provided in the TSPs for the exercise controllers, observer/controllers (O/Cs), and training participants. These sections were tailored to the information needs of each. This was noted by one respondent as having facilitated exportation of the SST TSPs to other simulation sites.

Content. The same missions were used across programs with the same terrain (central corridor of the National Training Center [NTC]), similar operations orders, and documentation describing the simulation.

Differences between the SST Programs (Interview Item B.2)

Many of the differences noted by the respondents were due to improvements over time (e.g., changes in TSP format based on user feedback) and/or changes in the training audiences and, hence, the training requirements (see Figures 1a and 1b). The respondents, when describing differences between the programs, used VTP as their referent when discussing either SGT or COBRAS. This being the case, VTP will be compared to SGT first and then to COBRAS.

Differences between VTP and SGT. Most of the differences noted between VTP and SGT fell into three general categories: training audience, training objectives, and Army support. Comments made regarding the use of a staff processes taxonomy will also be described.

The SGT training audience was described as one less experienced than that of the VTP. It consisted of potential staff officers who had little or no prior experience in performing collective staff duties. Further, they were not held to established training evaluation standards as few standards exist for staff processes. In contrast, the TSPs for the VTP were, in large part, based on Army Training and Evaluation Plan Mission Training Plans (ARTEP MTPs) providing established standards for combat performance.

The training objectives for both SGT and VTP were described as being appropriate for their respective training audiences and their needs (see Figures 1a and 1b). It was noted that the SGT TSPs did not allow flexibility regarding enemy and unit actions as did the VTP TSPs. The SGT was given high marks for its AARs. Respondents pointed to both the quality of feedback regarding training objectives and the SGT's combined use of small-group (i.e., section-level) AARs and large-group AARs.

In contrast, the VTP AARs were described as sometimes evolving into a tactical discussion rather than remaining focused on training objectives. This occurred despite the TSP guidance and tools provided for the VTP AARs. It was noted that this difference in AAR tendencies may have been, in part at least, a function of the VTP being more tactically focused. Further, the VTP TSPs were based more on such traditional precedents as the ARTEP MTPs. The SGT, in contrast, was focused on staff processes for dealing with message traffic and was not tactically focused at all. In addition, as the SGT was an entirely new training concept for the combat forces, it was not encumbered by traditional approaches.

The level of Army support for the VTP as compared to the SGT was described summarily by one respondent as: "The level of military support for VTP was very good; it was very bad for SGT." This is explained, in part, by these comments: the SGT "...was an entirely new training concept for the combat forces" and "SGT was launched without a safety net [i.e., there were no strong sponsors]." The concept for SGT was based on earlier research (Leibrecht, Meade, Schmidt, Doherty, & Lickteig, 1994; Lickteig & Emery, 1994) conducted at the Armor School. However, few representatives of the Armor School involved in the SGT projects had participated in or had knowledge of that earlier research.

Given these circumstances, SGT initially encountered considerable resistance. It is worth noting that acceptance and support did grow as the program progressed and became more focused. It is also worth noting that interest has since been expressed in making the SGT concept a part of the Army's Force XXI Training Program for the 21st century.

Differences between VTP and COBRAS. Differences noted by the respondents when comparing VTP to the COBRAS programs fell into three categories:

- evolution of the TSPs;
- extent to which these R&D efforts were exploratory in defining tasks and training objectives; and
- mission phases and simulation.

The differences noted between the TSPs for VTP and COBRAS were improvements as would be expected due to gaining experience and user feedback over time. For example, the use of "information mapping" (Horn, 1973) as a part of the TSP format was first introduced in VTP's SIMUTA-B effort. The SIMUTA-B TSPs were also described by the contractors, however, as "too huge." One contractor key developer described the subsequent COBRAS TSPs as gradually becoming "less verbose." The same respondent also noted that, whatever the problems, both VTP and COBRAS TSPs presented the key information and that this information was easy to find. (For further details regarding TSP changes over time, see Shlechter & Finley [in preparation]).

Some respondents pointed to the more exploratory nature of the COBRAS efforts in attempting to specify training objectives as compared to those of the VTP. Specifying objectives is a process requiring adequate identification and descriptions of the tasks to be performed by the soldiers. Action tasks and training objectives for the VTP programs were identified and fairly well described *a priori* by the Army's ARTEP MTPs and Situational Training Exercises (STXs), and these were what the Army expected to be used in development of TSPs. The primary VTP R&D questions were ones of how to best use this information in developing SST exercises, and then how to construct and format TSPs such that these exercises could be implemented as intended.

In contrast, many recognized that battle staff tasks were neither completely nor well defined. Many understood that resolving this issue might be a necessary first step. Indeed, the COBRAS and SGT programs did have to specify staff processes first, define these as tasks, and then translate these tasks into training objectives (cf., Shlechter & Finley, [in preparation]).

In developing their TSPs, COBRAS team members were able to draw upon the VTP experience. They found it advantageous, however, to use the term "performance objectives" and create a generic list of these objectives for the COBRAS TSPs. The need for this generic list was said to be due to the nature of staff processes and the working environment of cyclic mission phases. The term "training objectives" was then applied to those performance objectives selected for special attention during an exercise.

As described in Figures 1a and 1b, respondents pointed to VTP as having focused on the mission phase of execution while COBRAS addressed the planning and preparation phases as well. Addition of the planning and preparation phases increased the number of tasks to be trained and, hence, the set of training requirements. Additional comments were that: (1) Only the last of the COBRAS projects was truly multi-echelon with respect to training participants (i.e., training participants included personnel at both battalion and brigade echelons within a single exercise); this is in contrast to using role-players or "training aids" for echelons above or below the echelon designated for training; and (2) Only COBRAS developed any exercises that did not require use of a software-driven simulation. These were small exercises for staffs called "vignettes" (cf., Shlechter & Finley, [in preparation]).

Constructivism and Behaviorism/SAT Selections (Questionnaire Part III)

Overall differences between the constructivism and behaviorism/SAT approaches were discussed earlier and listed in Table 2. In contrast, Table 3 uses 13 elements to present a more detailed picture of differences between the two approaches. (The contrasting characterizations are based on an extensive review of the literature. See Shlechter & Finley [in preparation] for citations.)

The characterizations in Table 3 are the ones presented in Part III of the Contractor Questionnaire (see Appendix A). The respondents were asked to select those elements which had been applied to each of the program sets on which they had worked. Although they were informed that there was some controversy about the concepts, they were instructed to select all elements that had been applied, but only those elements. They were told that, if appropriate, they could select both the constructivistic and behavioristic versions of an element. Section A of the questionnaire requested these judgments for the VTP/STRUCCTT programs, while Section B requested the same for the SGT and/or COBRAS programs.

Table 3. Elements of the constructivism and behaviorism instructional theories.

	INSTRUCTIONAL THEORY ELEMENTS	
	CONSTRUCTIVISM	BEHAVIORISM
1	Training objectives determined by the training participants.	Training objectives determined by the instructional design team.
2	Training objectives also emerge as training participants interact with the training materials.	Training objectives determined as an initial part of the design process.
3	Task(s) immerse(s) participants in realistic battlefield conditions for their echelon.	Task(s) does not/do not need to immerse training participants in realistic battlefield conditions for their echelon.
4	Course materials focused on developing a unit's higher order cognitive skills (e.g., its tactical decision-making).	Course materials focused on developing the unit's procedural-level tactical skills (e.g., executing tactical formations).
5	Course materials focused on helping participants' develop the skills necessary to fight in new and different battlefield conditions.	Course materials focused on helping participants' develop the skills necessary to fight in battlefield conditions which resemble the scenario.
6	Instructional program need not contain a standardized set of instructional materials.	Instructional program must contain a standardized set of instructional materials.
7	Instructional program does not contain a particular instructional sequence (e.g., "crawl-walk-run").	Instructional program contains a particular instructional sequence (e.g., "crawl-walk-run").

(table continues)

Table 3 (Continued)

	CONSTRUCTIVISM	BEHAVIORISM
8	Instructional materials developed for the more experienced or advanced training participants.	Instructional materials developed for the less experienced or novice-level participants.
9	Experiential learning is more important than mastery learning.	Mastery learning is more important than experiential learning.
10	Instructional personnel should refrain from providing performance feedback to the participants as they are executing a table.	Instructional personnel should, if needed, provide performance feedback to the participants as they are executing a table.
11	Student-led AARs.	Instructor-led AARs.
12	Feedback geared more to the unit processes (e.g., communication among tanks) associated with any particular action (e.g., getting to the Line of Departure(LD)/Start Point (SP) on time) than to the action itself.	Feedback geared more to the unit's actions (e.g., getting to the LD/SP on time) than to the processes (e.g., communication among tanks) associated with its action(s).
13	A non-linear or spiral progression used in the instructional design process.	A linear or spiral progression used in the instructional design process.

Three issues were of interest:

- Which of these elements were used in developing and implementing the SST programs?
- Were there overall differences between the VTP/STRUCCTT, SGT, and COBRAS programs regarding their use of the two instructional approaches?
- Were there differences between the VTP/STRUCCTT, SGT, and COBRAS programs regarding which elements were used?

Presentation of the Data

To address these issues, the respondents' selections of elements were grouped into a matrix of cells defined by these three factors: the 13 elements; two instructional approaches; and three SST program sets. The number of participant responses possible in a matrix cell for either VTP/STRUCCTT, SGT, or COBRAS were, respectively, N = 12, 5, and 8.

(Table 1 and Figure 2 indicated that the N for SGT was 7, where two of these persons also worked on the COBRAS program. In completing this particular questionnaire section, these two persons indicated that the elements they selected were appropriate for both COBRAS and SGT. A decision was made to count their responses only once, assigning them to the COBRAS column. Hence, the SGT N = 5 in this instance, rather than the N = 7 used elsewhere.)

This matrix is presented in Table 4 with the response data displayed in two formats: (1) number of persons choosing this element (unboldened) and the proportion choosing it (boldened). The proportions shown are the frequency with which it was selected divided by the maximum number possible for that program (maximum Ns = 12, 5, and 8). The summary proportions shown for each program for each of the two instructional approaches are the responses summed across the 13 elements and then divided by the maximum sum possible for that column. The maximum possible sum for VTP/STRUCCTT was 13 x 12 = 156; for SGT, 13 x 5 = 65; and for COBRAS, 13 x 8 = 104.

The Findings

Similarities across the SST programs. Table 4 presents the data for all 15 respondents concerning the constructivist and behaviorist aspects of SST R&D programs on which they had worked. This table provides insights into the instructional design characteristics of ARI's SST programs. With regard to similarities, there were six SAT/behaviorism elements that were selected across all SST programs by 60% or more of the respondents. These six elements are highlighted in gray in Table 4 and include:

- The SST instructional design team determines training objectives and does so early in the design process (elements 1 and 2).
- The SST program must contain standardized materials (element 6).
- The SST program must contain a particular sequence (element 7).
- Instructional materials are developed for more novice participants (element 8).

Table 4. Frequency and proportions of selections per constructivism and SAT/behaviorism element across the VTP/STRUCCTT (VTP/STR), SGT, and COBRAS sets of programs

Legend: ▭ Highlights proportions of .60 or higher across the three sets of training programs.
■ Highlights program proportions which are substantially different than those of the other program(s).

SELECTION FREQUENCIES AND PROPORTIONS PER SST PROGRAM SET FOR ALL RESPONDENTS								
	CONSTRUCTIVISM ELEMENTS	VTP/STR N = 12	SGT N = 5	COBRAS N = 8	SAT/BEHAVIORISM ELEMTS	VTP/STR N = 12	SGT N = 5	COBRAS N = 8
1	Training objectives determined by trng participnts	6(.50)	3(.60)	5(.63)	Training objectives determined by design team	12(1.00)	4(.80)	7(.88)
2	Training objectives also emerge with interaction	6(.50)	2(.40)	5(.63)	Training objectives determined early in design	12(1.00)	5(1.00)	7(.88)
3	Tasks immersed in real battlefield conditions	11(.92)	3(.60)	4(.50)	Tasks do not need immersion in real conditions	0(.00)	2(.40)	3(.38)
4	Course materials focus on cognitive skills	6(.50)	4(.80)	8(1.00)	Course materials focus on procedural skills	10(.83)	2(.40)	4(.50)
5	Course materials focus on new/different conditions	5(.42)	3(.60)	4(.50)	Course materials focus on common scenarios	8(.67)	3(.60)	3(.38)
6	Instructional program need not have standard materials	1(.08)	0(.00)	0(.00)	Instructional program must contain standard materials	10(.83)	5(1.00)	8(1.00)
7	Instructional program need not have particular sequence	2(.17)	0(.00)	1(.13)	Instructional program contains a particular sequence	10(.83)	5(1.00)	6(.75)
8	Instructional materials dev for more advanced participants	4(.33)	0(.00)	3(.38)	Instructional materials dev for more novice participants	11(.92)	5(1.00)	7(.88)
9	Experiential learning more important than mastery	6(.50)	3(.60)	7(.88)	Mastery more important than experiential learning	5(.42)	2(.40)	1(.13)
10	Instr personnel should refrain from gvng feedback in exercs	4(.33)	1(.20)	1(.13)	Instr personl should, if needed, give feedback in exercise	9(.75)	3(.60)	7(.88)
11	Student-led AARs	1(.08)	3(.60)	5(.63)	Instructor-led AARs	10(.83)	2(.40)	6(.75)
12	Feedback geared to process rather than actions	7(.42)	3(.60)	8(1.00)	Feedback geared to actions rather than process	6(.50)	1(.20)	1(.13)
13	Non-linear or spiral instructional design process	5(.42)	1(.20)	6(.75)	Linear or sequential instructional design process	5(.42)	2(.40)	0(.00)
	∑ and proportion (∑ ÷ Nx13)	64(.41)	26(.40)	57(.55)	∑ and proportion (∑ ÷ Nx13)	108(.69)	41(.63)	60(.58)

- ♦ Instructional personnel should, if needed, give feedback during an exercise (element 10).

Hence, a similarity across the SST programs was the greater use of the SAT/behaviorism approach to instructional design. The use of this approach is further indicated by Table 4's summary data for behaviorism/SAT (.69, .63, and .58).

Differences between the SST programs. Table 4's data also indicate several key differences between VTP/STRUCCTT, SGT, and COBRAS with regard to which of the behaviorism and constructivism elements were applied. These differences are highlighted in Table 4 by using contrasting black and white cells (e.g., for element 4, note the values of .80 and 1.00 for SGT and COBRAS, and .83 for VTP/STRUCCTT). These key differences are as follows:

- ♦ The VTP materials tended to focus upon training units to develop their procedural skills, while the COBRAS and SGT materials tended to focus upon training units to develop their cognitive skills (element 4).

- ♦ Experiential learning was more important for the COBRAS programs than for the VTP/STRUCCTT programs; mastery learning was much less a focus of the COBRAS program than for the VTP/STRUCCTT programs (element 9).

- ♦ Feedback focused more on a unit's actions in the VTP/STRUCCTT programs, whereas feedback for the COBRAS programs focused more on tactical processes (element 12).

- ♦ A non-linear instructional design process was more pronounced for the COBRAS R&D efforts. In contrast, the use of non-linear and linear processes in VTP/STRUCCTT efforts appeared, to the respondents, to be balanced (element 13).

While SGT tended more toward behaviorism/SAT selections, it did not consistently line up with the differences noted between VTP/STRUCCTT and COBRAS. Given the uniqueness of SGT as a program designed to transition soldiers from individual to collective training for staff positions, its alignment with the two instructional approaches appears reasonable.

Constructivism and SST. The use of constructivism in designing and developing the SST TSPs is also evident in Table 4, although to a lesser degree. Most of the constructivism elements received a reasonable number of responses across the SST programs. Moreover, the constructivism and behaviorism elements each received nearly the same number of responses for the COBRAS training programs. Hence, the different SST efforts reflected both the behaviorism and constructivism approaches to instructional design, with the latter approach being more evident for the COBRAS R&D efforts.

Another note concerning the constructivism approach can be made based on examination of the proportions of respondents choosing elements 1 and 2 under the constructivism column in Table 4. While the predominant use of SAT/behaviorism's elements 1 and 2 was noted earlier, several respondents also chose the constructivistic version of elements 1 and 2. When queried about their choices, the respondents said that some units were observed to play at least some role in determining their training objectives. They described that role as being one of reviewing the available TSPs before initiating their training, selecting the ones they felt to be most appropriate. And, at times, training participants did identify additional objectives after completing an SST exercise. These additional objectives were described as emerging when units recognized indications of unanticipated skill deficiencies and/or gained a better understanding of the simulation's capabilities.

A Tangential but Interesting Finding

Given the non-homogenous composition of the respondent population, the data were also examined during analysis to determine if there were any patterns reflecting individual respondent differences beyond the anticipated differences between elements and between SST programs. An interesting difference was found within the group of respondents who had worked on more than one program, of which there were 11 (see Figure 2). Approximately half of them (N = 6) provided different instructional theory selections for each of the two or three programs on which they had worked for some of the 13 elements. Further, these choices appeared to be reasonably consistent across the 6 respondents. The other half (N = 5) made different selections for each program on no more than one element, if that. The data on these two groups were compared and it was determined that some background differences existed which might explain this tendency, on the part of some respondents, to differentiate between programs. Given this finding, the background data and instructional theory choices of those persons we will call the "differentiators" - as compared to the "non-differentiators" - are also presented, but separately in Appendix D. This is intended to allow readers, if they are so inclined, to decide for themselves which data set best answers the issues.

The data trends for the differentiators were found to be the same as they were for the entire group of 15, only stronger (i.e., the patterns of proportions appearing in Table 4 and Table D-2 are quite similar). The data from the differentiators, despite the very small Ns, are of interest because: (1) They confirm the trends appearing in Table 4 and (2) They reaffirm the value of examining the effects of individual differences whenever feasible.

RESULTS: NEEDS FOR AN SST DEVELOPMENT MODEL, FRONT END ANALYSES, AND RESEARCH TO IMPROVE THE APPLICATION OF SST

An SST Development Model

The more tightly a scenario is detailed and controlled with regard to closely defined training objectives, the more "structured" a training exercise becomes. The COR key developers presented the issue of how much structure is needed as one moves to different echelon and/or skill levels. The questions were:

- To what extent can or should structure be imposed?
- How is it best accomplished?

The term "model" is used here to suggest a conceptual framework and knowledge which could guide SST TSP development activities related to the above questions. That guidance could concern such issues as choice of instructional design features, scenario scripting, and matching skill levels to simulation capabilities.

Instructional Design Elements

Contrasts between behaviorism/SAT and constructivism can be an important consideration in designing TSPs. Some have argued that the behaviorism/SAT approach is more useful for procedural and mechanical skills, while constructivism is more appropriate for leadership and cognitive skills. One finding from review of the SST programs (Shlechter & Finley, [in preparation]) and confirmed by data collected for this report (see Table 4) has been that application of design elements selectively chosen from both approaches, and perhaps others as well, may be a more effective approach. A clearer understanding is needed regarding which instructional design elements would be most appropriate under what conditions.

Scenario Scripting

Key developers described the higher echelons as more complex and difficult to control. They noted that this is exacerbated by the fact that the software currently used to run training simulations, especially ones for higher echelons, can neither be scripted easily in accordance with the details of an SST scenario nor easily modified. The CORs suggested that a review of instructional design elements like those in Table 4 and a sample of SST TSPs might be made in conjunction with an examination of current simulation programming languages and techniques. The goal would be to identify enhanced scripting techniques and/or technologies which could afford greater flexibility in controlling scenarios.

Matching Skill Levels to Simulation Capabilities

Large and complex constructive simulations like BBS are expensive to run from the standpoints of needed support personnel and facilities. A concern expressed by the CORs was that such simulations are not only costly, they are not very effective if the soldiers have not yet acquired the necessary "gate" skills. Gate skills are those that need to be acquired first before attempting to perform the collective tasks appropriate for training in a BBS environment. The question the CORs raised was, "To what extent might more extensive use of inexpensive small group staff exercises, similar in concept to crew drills for a platoon, prepare soldiers to then receive maximum training benefits from a BBS exercise?" The CORs suggested that such exercises should also lend themselves readily to effective structuring.

Front End Analyses (FEAs)

One COR, when asked to identify "the top ten tricky SST issues," did name ten of them. For five of these, most of them at the top of the list, the COR recommended conducting FEAs to resolve them. If FEAs, also commonly referred to as "needs analyses," were to be conducted then the results from these should serve two purposes:

- provide a foundation for an Army SST Master Plan; and
- identify those tasks constituting the minimum essential set of tasks needing to be trained, the nature of their training requirements, and the best training strategies for them.

Such FEAs were described by the CORs as being important avenues toward fully realizing SST benefits and doing this in the most efficient manner.

Establish a Foundation for an Army SST Master Plan

Both CORs made many comments regarding how they wished they had been able to start at the beginning of their SST R&D, with the knowledge they have now, to develop plans of greater scope and to do so within a larger Army context. They wished that they had been able, much earlier, to understand the need to more completely consider the "big picture" and conceptualize at a macro-level. They suggested several ideas which, if tied together, might well constitute an outline for a "Master Plan" for SST. The planning-related needs for FEAs were described as ones providing a better definition and organization of the Army's overall training requirements, and approaches to satisfying these requirements.

A caution was offered by the CORs regarding any FEAs that might be done to provide a framework supporting integrated development and use of TSPs across echelons. These FEAs should start at the corps echelon and work down to platoon level. Because this was not done in the VTP program (i.e., an FEA was not available and TSPs were first developed for the platoon level), the current set of VTP TSPs cannot be easily used in combination with COBRAS TSPs, which were developed for brigades responding to division orders.

Identify Minimum Essential Set of Tasks for Training

FEAs were also suggested to identify: those tasks constituting the minimum essential set of tasks needing to be trained; the nature of the training requirements for these tasks; and the best training strategies for them. We suggest that an intent to perform these FEAs could be placed in the proposed Army SST Master Plan.

The CORs recommended that these more specifically focused FEAs be performed within the context provided by the overall picture(s) of training requirements discussed above. These FEAs could focus on, for example, a particular type of unit (e.g., an armor unit) and attempt to determine for that unit: what are the most essential tasks to be trained and what should the progression of training be (e.g., sequence, repetitions, c-w-r events, mission and environmental contexts). These requirements could then be matched to what can be done in the available virtual, constructive, and live simulations.

As FEAs identifying the minimum set of essential tasks for training are completed for a unit, these analyses could be extended to functions requiring external coordination (e.g., requesting indirect fire support from another unit or higher headquarters). A desirable goal would be to identify 5 - 10 sets of the most essential skills on which training would focus in a unit. For example, integration of direct and indirect fire skills might be identified as one of the essential sets.

Both CORs mentioned Lieutenant General(R) Brown's concept of a three step training strategy which has been published as part of a U.S. Army Training and Doctrine Command (TRADOC) memorandum (U.S. Army Training and Doctrine Command, 1998). The three steps are: (1) learn the basics (e.g., warfighting skills like gunnery); (2) become proficient in the tasks, conditions, and standards of needed hardware and software; and (3) develop highly adaptive hyperproficient individuals, small teams, and units. Some of the SST key developers along with some others, in discussing the three step strategy, expressed opinions that even completing step 2 training to the point where they are able to enter step 3 training would be very difficult in most cases. This is due to resource limitations and other constraints facing most units. One COR suggested, however, that if FEA were able to establish small enough sets of minimum essential skills and if research also established ways to primarily train those skills alone (e.g., through repeated use of varied vignettes and

TSPs) such that soldiers could adequately transfer and adapt to situations requiring other tasks to be performed - then a step 3 level of expertise might be attainable on those sets at least. This COR suggested that this would take the concept of structured training a step further - train and test on only a small set until the soldiers are indeed experts on these.

Transfer of Training Methods Research

Whatever the training or education being provided, three key questions are: (1) Will it contribute to soldiers' ability to perform effectively in future instructional and/or operational endeavors?; (2) To what extent will this contribution cover a variety of events and surrounding conditions?; and (3) Is it an efficient means for doing this? If the answer to the first question is, "yes," then the training is said to have "positive transfer." If the answer to the second question is, "positive transfer, but only to one type of situation," then the transfer is limited as opposed to general, or generic. If the answer is not only, "no," but that it hinders performance as well, then the training is said to have "negative transfer."

Several aspects of training transfer related to SST will be discussed here: the "nesting" concept, adaptive thinking, training bridges, and training measurement. Except training measurement, the translation of all of these from research findings into applications would be in the form of training methods or techniques. Good measures of training results are necessary tools for both research and application, providing the needed diagnostic and evaluative information. These topics are closely interrelated and they could affect the extent to which SST transfers positively, especially to operational environments.

The Nesting Concept

Some key developers suggested that research was needed into the relative benefits of "nesting" missions and orders versus using different missions and scenarios. The term "nesting" is defined as using the same missions and operations orders at each echelon. (Terrain was not an explicit part of the nesting definition because the central corridor of NTC was the only terrain available during ARI's SST R&D.) The intent of nesting is to enable a tank platoon, for example, to train separately using a TSP for a defense mission, and then to train again, later, as a platoon within a company performing the same mission. In each case, a defense mission would be executed using the same orders, tailored only as needed to reflect differences between platoon and company echelon responsibilities. One contractor described the good and bad features of nesting as being: "The good feature of nesting is it gives a common framework across echelons and probably enhances training effectiveness as well as efficiency. The bad feature is that people think that by nesting, what is done in one environment will necessarily transfer to any other environment. This may not be true because changes in mission, enemy, terrain, troops, and time available (METT-T) does change performance requirements." The concern of several respondents was that more TSP variations in mission, scenario, and operating environment may be needed to ensure transfer of training. Their question, as stated by one, was: "How much variety is enough?"

Adaptive Thinking

A concept, addressed earlier in discussing FEAs, was whether there might be some minimum number of essential task skill sets on which training, with varied vignettes and TSPs, could focus on a continuing basis. It was suggested by one COR that - if it were determined that continued training on primarily these tasks would "provide adequate transfer and adaptation to situations requiring other tasks to be performed - then Step 3 expert performance levels could be achieved."

Adaptive thinking is a skill beyond simple recognition and reaction to similarities between training and operational environments. It consists of having learned how to adapt one's knowledge to new situations and how to identify what additional information is needed (Finley, Sanders, & Ryan, 1996). Adaptive thinking is thus a proactive component of training transfer. If minimum sets of necessary skills were identified, then research to establish a means of training this proactive aspect of transfer of training might increase the benefits of SST even further.

Training Bridges

Another aspect of training transfer addressed by one key developer was how to enable soldiers to understand and appreciate how their previous virtual and constructive simulation-based training applies to their live training, especially Combat Training Center (CTC) rotations like NTC and Joint Readiness Training Center (JRTC). Soldier training participants have been observed to question the value of their prior virtual and constructive simulation-based training when they experience things at CTCs not experienced before or in the same manner.

The problem here may be one of CTCs being viewed as "the real world;" that is, as being much closer to combat reality than is actually the case. In fact, the CTCs are simulations as well. They too are limited in the realities they can simulate and these limitations are not always apparent to many training participants. The bottom line is that R&D is needed to determine means for enabling soldiers to better link and appreciate their CTC and other simulation-based training experiences; and to understand the ways in which they each differ from true reality.

Training Measurement

Good measures of performance are key to effective AARs in both evaluating the performance of training participants and diagnosing their problem areas. However, as one COR observed, "We never succeeded in finding an evaluation form that the O/Cs liked and would use without prodding." The COR suspected it was not only the filling out of forms that the O/Cs disliked, but that it may also have reflected their opinions regarding the utility of the information gained. A research need identified by both CORs concerned the requirements for measures that would provide data more useful to the AAR process. They also emphasized the need to automate, to the fullest extent possible, the collection and analysis of data obtained using these measures.

Better (i.e., more useful) measures of performance are needed not only for training AARs, they are also needed in efforts to assess operational performance. To the extent good measures of performance can be identified for AAR purposes, they may also be found useful in efforts to evaluate the extent and nature of training transfer to the operational environment.

RESULTS: ARMY SST MASTER PLAN, LOGISTICS SYSTEM, AND POLICY

In the Rationales and Issues section, it was indicated that one of the purposes of this report was to identify insights into how to make SST a regular part of Army training. Based on analyses of the information obtained from ARI's key SST developers, recommendations for an Army SST Master Plan and Logistics System, along with related policies, will be described in this section. Prior to presenting these recommendations, however, information drawn from the key developers will be provided as background.

Background

SST Contributions to the Military Training Community

SST training benefits were described by contractor key developers as being the major contribution and one that was "validated." The term, "validated," was used to convey personal opinions based on direct and repeated observations of unit performance improvements resulting from the use of SST TSPs. These improvements were observed during formative evaluations of TSP prototypes and, in some cases, subsequent operational uses of the TSPs. Several contractors went on to describe the training benefits from a larger perspective of training simulations in general. This general benefit was summarized by one as: "The Army was shown how to use their simulations so as to realize their training benefits rather than wasting them."

Observations of training effectiveness were noted for all the SST programs: VTP, COBRAS, and SGT TSPs. Improvements in performance were most explicitly described for the platoon and company VTP TSPs, where actions and processes are more discrete and directly observable. One succinct summary was that units progressed from being "...unproficient and disorganized to becoming much better." Another respondent estimated that, "The 'light bulb goes on' after completion of TSPs for about 80% of the units."

Evidence that there is a growing appreciation of SST benefits was a recent policy statement on the part of the U.S. Army Training and Doctrine Command (TRADOC). This statement described the strategy to be used in developing exercises for digital instruction (TRADOC, 1998). It cited SST's SGT and COBRAS programs as the development models to be followed.

SST Problems

Nature and value of SST are not widely known. Despite the TRADOC memorandum noted above, knowledge and appreciation of SST are not widely held across the Army. Army personnel who have had very limited or no experience with SST TSPs find it difficult to fully understand or appreciate the value of SST. One key developer succinctly summarized the requirement as: "Everyone must understand that structured training is different - it is not 'free play' nor is it 'bonding with the generators.'" The problem was described as one of "...trying to get folks to truly understand structure and its real value, and to share in the larger training picture."

One COR summarized the situation by asking the question: "For SST, the Army has actually had to relearn SAT - how do we avoid this with SST as well?" Both CORs and contractors expressed concern that the understanding of training that many in the Army gained though the SST R&D programs could easily be lost. The SAT concept and AAR procedures were pointed to as examples of where, even though these approaches were first developed and formally adopted by the Army, this original knowledge base has not been maintained. Many now in the Army, while using the SAT and AAR acronyms and believing they are following the regulatory guides, are actually only following examples they have observed. These examples, unfortunately, have often been poor ones. While some soldiers, seemingly through instinct, are excellent training developers and executors, most others need to be tutored and then receive guided experience. Providing this type of instruction is not a current practice for SAT or AARs, let alone SST.

Enjoying "free-play". The VTP was the first of the SST R&D programs and was directed to apply the capabilities of SIMNET to a serious training problem (see Shlechter & Finley [in preparation] for details). Even though Congressionally supported, however, the concept of structured training in SIMNET was not immediately popular. The SIMNET had already been in use for a while and had been used largely in a free-play mode. In addition, as noted by some key developers, training participants and O/Cs were accustomed to making the decisions in managing and controlling the training exercises themselves. Unfortunately for those soldiers enjoying free-play and accustomed to personally making the training decisions, it was determined that these actions were counterproductive to realizing SIMNET's training benefits (this was discussed earlier in the Background section). Attempting, therefore, to apply the SST concept and procedures to SIMNET required some adjustment on the part of many. Conducting exercises in accordance with standardized TSPs developed by others was a new way of doing business.

Making training decisions. One key developer commented that, "In part, there is a tendency to think that, because they can operate a piece of equipment, they automatically know all about tactics and doctrine, how to implement them, and how to fight." An example of this assumption is that, on not infrequent occasions in the VTP/STRUCCTT and SGT programs, military personnel would object that many of the TSPs were "too easy" and, hence, not worth their time. Many key developers noted, however, that observation of the performance of said units, while using these "too easy" TSPs, often indicated otherwise. In fact, in some cases, they appeared to be too difficult.

The CORs described two factors relating to this problem. First, it is doctrine (DA, 1988, 1990) that commanders are the ones responsible for specifying the training for their units, based on their knowledge of their unit's needs. This doctrine supports an apparent assumption that commanders "know" what their unit's training needs are and how to address them correctly. This assumption works against acceptance of SST TSPs, which require adherence to training procedures that are already specified in detail (as is necessary if the training is to be standardized).

The second factor is that there is currently no instruction systematically provided to officers or Non-Commissioned Officers (NCOs) (on, e.g., SAT concepts or how to give AARs) to provide them with a basis for meeting their training responsibility. It is not lack of overall competence; but it may be the fact that unit commanders frequently lack an appropriate basis for evaluating their own unit's performance and then defining training objectives based on that knowledge.

Long-term support needed for SST. Both CORs and 60% (9 out of 15) of the contractors identified needs for sustainment and continuing development of SST TSPs. Sustainment issues included distribution of TSPs to potential users and maintenance of a central TSP library. Another was the need to update current TSPs when doctrinal and other changes take place.

Continuing development of new TSPs was stressed by many key developers as needed to cover missions, terrains, and forces differing from those already addressed in currently available TSPs. Some circumstances needing new TSPs were described: stability and support operations (SASO); digital operations; and terrains and forces encountered in Somalia, Bosnia, and Korea.

Another type of needed support identified was to educate the Army regarding the SST concept and its use. One key developer summarized this need by saying: "Better education of the force is needed. [Currently] only trial units know about the programs and what they will do for them."

Recommended Solutions

Given the foregoing description of SST benefits and problems, possible solutions were formulated in terms of an Army SST Master Plan and an SST logistics system. Possible frameworks for these are outlined below. The SST Master Plan and logistics system are seen as courses of action that, if adopted, may be able to provide management, policies, and resources essential for successful long-term SST implementation and sustainment.

Proposed Army SST Master Plan

Suggested components for the proposed Master Plan are:

- FEAs
- TSP development
- implementation
- organization(s)

Each of these components are discussed below.

To the extent that any of these areas are addressed, the CORs strongly advise the early and continuing involvement of both users (e.g., using Army units) and implementers (e.g., O/Cs) of any products (e.g., TSPs). They stated that their inputs can be valuable and their later support will be essential.

SST FEAs, or needs analyses. FEAs were described earlier as one of three areas of SST needs. Two major purposes were identified for the FEAs: (1) to establish a foundation for an Army SST Master Plan and (2) to identify those tasks constituting the minimum essential set of tasks needing to be trained. The FEAs needed for the SST Master Plan were described as ones providing definition of the Army's overall training requirements and approaches to meeting these requirements. Here, one intent of FEAs might be to fit SST into the larger framework of Training Aids, Devices, Simulators, and Simulations (TADSS) for the Combined Arms Training Strategy (CATS) (DA, 1993). This will be addressed shortly in more detail as it concerns SST implementation.

Although discussed earlier as a need to "establish a foundation" for a master plan, perhaps a statement of need for FEAs should be made a part of the master plan as well. Here, the intent to identify requirements for and then perform FEAs as needed could be expressed as a part of the plan.

SST TSP development. As a part of the SST Master Plan, a statement of the purpose(s), use, and contents of SST TSPs could be provided. If appropriate, this could be coordinated with updates to the section in TRADOC Regulation 350-70 (DA, 1995) covering TSPs as a general concept.

A section in the proposed SST Master Plan on SST development could include a statement regarding possible needs for additional SST TSPs and examples of the benefits they could provide. As an example, a general statement of the need to include CS and CSS positions and operations in at least some staff TSPs, and where this might be most appropriate, might be included. In addition, conduct of FEAs could be suggested as a means of providing definitive information for frameworks initiating new TSP development efforts.

Another development consideration that may warrant attention would be tools like the Commanders' Integrated Training Tool (CITT) to support unit efforts to adapt existing SST TSPs to meet their own individual requirements and constraints. The CITT is being developed to support CCTT, but the concept should be generally applicable to other training simulation systems as well (Gossman et al., 1999).

SST implementation. TRADOC's CATS (DA, 1993) may need to be directly addressed in an SST Master Plan. A major focus of CATS is on TADSS and planning for their use in unit training (see U.S. Armor Center, 1999 for an example of a branch-specific training strategy based on a CATS foundation). Simulator and simulation components of TADSS offering SST TSPs should merit special attention. The concept of CITT, mentioned above, could be addressed in this section of the master plan as well. The implementation concept could also integrate the suggestion that SST should be required of units on a regular basis, being scheduled and prepared for accordingly. This is further discussed below as a part of an SST logistics system.

SST organization(s). The Army already has a National Simulation Center (NSC), located at Fort Leavenworth, KS. Its responsibilities are largely concerned with simulations for brigade and above (e.g., BBS, Corps Battle Simulation [CBS], and the new Warfighter Simulation 2000 [WARSIM 2000]). This agency has some simulation management and training oversight responsibilities, and is a central facility for local and off-site operations of the CBS. A "CTC for SST" idea could be couched within the framework of a NSC- and/or NTC-type of facility/agency for collective training simulation devices, but as one, instead, having responsibilities for brigade and below training. Training simulations and simulators of interest would include BBS and CCTT. If the proposed concept of integrating lower echelon training into WARSIM 2000 is realized then perhaps this could be a part as well. Uncertainty was expressed by the CORs as to whether this SST organizational concept could or should be realized as a central facility or, rather, as a geographically distributed organization.

Proposed SST Logistics System

One of the CORs expressed the need for a means to sustain the concept of SST and the SST TSPs themselves in an especially succinct manner: "In the SST programs to date, we have developed a Development Focus Model. What we now need is an Implementation Focus Model." The SST logistics system proposed here may be described as a formulation of such a model. For purposes of discussion, the label will be, "SST logistics system," as if it were to be a singular entity. It is recognized that this capability could well be an added responsibility for already existing parties.

Both CORs discussed the need to determine how to best sustain and update the structured training programs, and to then implement these approaches. It was suggested that an SST program implementation model would be quite separate from the already established SST development model, even though complementary. The CORs offered ideas regarding purpose, participants, and functions that a logistics system should either perform or be associated with, and an operating principle.

Some logistics implications for training systems were described in addressing the implementation of embedded training (Cherry, Peckham, Purifoy, & Roth, 1988). This effort by Cherry et al. is the only one known by ourselves to address a category of training systems, as opposed to one singular device. It is also the only one we know of which focuses attention on training systems driven by computer hardware and software requiring continuous monitoring for needed changes and timely responses to meet these needs.

Many of the SST key developers commented on the need for SST TSPs to become a regular part of training. As this issue is very much a part of the reason for needing SST logistical support, this will be discussed here before proceeding with the topics of logistics purpose, participants, and functions. The "be a regular part of training" concern was addressed with regard to two aspects: training scheduling and instructional emphasis. The concept offered was that SST should be required, regularly scheduled, and given a high priority. The priority given it could be similar to that of training at NTC by brigades.

Several key developers, both CORs and contractors, cautioned that the prioritization should be focused on instructional needs - not on, for example, rehearsing for a later event. Many of the key developers described occasions where units attempted to modify the SST TSPs to match conditions expected to be a part of their NTC rotation and then use these TSPs as a means for preparing for that NTC rotation. It was noted by some that these attempts appeared to result from the importance attached to performance at NTC rotations and a failure to fully recognize the needs for instruction not provided by rehearsals.

In underscoring the instructional emphasis, COR key developers also cautioned that regularly scheduled SST training should be "task-based," that is, based on identified training requirements. It should be centrally focused on identifying and addressing the unit's current skill deficiencies and needs for skill maintenance. It should not become what is known as "event-based training." This is a term often used to describe training viewed as a scheduled event that must be checked off the list of things that must be done, rather than as a means for addressing training needs.

Logistics system purpose. If an Army SST Master Plan is developed, and if the need for support and sustainment is accepted, then the purposes and functions of a logistics-type capability could be a part of this master plan. This could be a foundation upon which an SST logistics capability would be built. A dictionary definition provides a framework for more exact definitions of the purposes to be served by a SST logistics system: Logistics is the procurement, maintenance, distribution, and replacement of personnel and materiel (Lexical & Electronic Database Management & Staff, 1994).

Logistics system participants. A general concept for SST organization(s) was discussed above as part of the SST Master Plan. Simulation centers and regional training centers would certainly need to "buy into" the SST concept as being the providers thereof to units on a regularly scheduled basis. Having SST at these facilities would create a requirement for units to come to them if they did not have adequate facilities at their home station.

Other players certainly would include the Army Training Support Center, TRADOC, and schools such as the Armor Center who host and/or use simulation facilities. Additional participants would certainly include operating commands (e.g., U.S. Army Forces Command) and units (e.g., First Cavalry at Fort Hood).

Among other responsibilities related to logistics, operating commands and units may be able to identify training or logistics requirements from their perspectives for which they can provide personnel support (e.g., military role-players for SST exercises).

Logistics system functions. Functions for the logistics system were identified earlier, as a part of the discussion of SST problems, as being: long term support for sustainment, continuing TSP development, and force education. These three functions do not need to be discussed further here. The CORs, however, suggested two additional sets of functions: (1) oversight and management; and (2) monitoring and evaluation. Their comments are addressed next.

Examples of the oversight and management functions identified by the CORs were to:

- Identify and initiate internally-driven programmatic actions on SST TSPs. Examples of "internally-driven programmatic" changes are ones like correcting programming errors, adjusting to changes in system hardware or external software, or introducing possible enhancements.

- Identify and initiate actions on TSP programs due to external reasons like changes in doctrine or need to use an existing TSP in a different terrain setting.

- Coordinate and systematically schedule installation of new and modified hardware and software.

- Identify new TSPs that are needed and prioritize them for development. It was suggested that one or more steering committees might be formed to perform this function. Whether such committees should be permanent ones or, instead, be assembled from the most appropriate organizations as the need arises, or a combination of both, was discussed but not resolved. What was clear to the respondents, however, was that the members of such a steering committee should possess ranks and positions such that their decisions would be respected and accepted by others.

- Determine the tasks, conditions, and standards to be met by contract logistics support (CLS) personnel for simulation facilities, and bring all CLS contracts into alignment with these. A follow-on task is to monitor contract performance in coordination with local agencies to ensure effective compliance. When appropriate and feasible, an effort should be made to include a contract requirement for truly qualified position role-players, or "training aids," as needed to effectively support TSP exercises.

- Develop, manage, and sustain a team similar to the concept of a New Equipment Training (NET) Team, or NET Team, to train the trainers using SST. This would be especially valuable where SST trainers are unit personnel who are not part of a permanently established training group having that as their primary mission. This is expected to be a continuing need for those simulations not having a highly skilled permanent O/C team. (The VTP program is an example of a program having a dedicated O/C team. In contrast, CCTT, which STRUCCTT addressed, will not.)

The second additional set of functions, those suggested by the CORs, monitoring and evaluation, concerned the need to identify requirements for changes to SST in meeting training needs as a member of the overall Army training system. Such changes could be ones in roles or Standard Operating Procedures (SOPs), or changes to adjust its training utility and/or effectiveness. This concern was expressed with acknowledgment that evaluative agencies addressing training have either largely ceased to exist (e.g., TRADOC School Directorates of Evaluation and Standardization) or are no longer strongly active in this area (e.g., TRADOC Systems Analysis Activity). The TRADOC and others are very concerned about this deficiency, but do not presently have the resources needed to increase their evaluation capabilities. Perhaps the best solution for now is to ensure that any SST steering committee and/or logistics system be designed to maintain effective coordination and feedback loops with simulation users.

<u>Operating principle</u>. Both CORs strongly stressed the need to use simulations in accordance with their simulation and operation capabilities. For want of a better label, we are calling this the "operating principle." Examples of good and poor uses of SIMNET and BBS were provided by the CORs:

- The SIMNET was designed for training the tasks of mission execution and is very capable of simulating terrain and other features of the physical environment. But, while using SIMNET to train tasks performed during the mission phases of planning and preparation is feasible, the simulation capabilities of SIMNET are largely ignored because they are unnecessary.

- The BBS offers many simulation capabilities appropriate for large command post exercises. However, these capabilities are not needed for, and are entirely too costly and large in scope for supporting small group staff training of limited scope. Here, vignettes in an ordinary office setting with supporting paperwork may provide all that is needed to simulate a working environment.

SUMMARY AND CONCLUSIONS

At the beginning of this report, it was noted that the findings derived from the structured interview and questionnaire data clustered into three main areas. These areas are:

- Contributions of the constructivism and behaviorism instructional theories to the SST programs;
- Needs for further information and research; and
- Planning and logistical requirements for integrating SST into the Army's training system.

Contributions of the Constructivism and Behaviorism Instructional Theories to the SST Programs

Similarities found across the SST programs were the use of certain instructional design and implementation elements of behaviorism. These shared elements were: early determination of training objectives by the TSP design team; use of standardized materials; TSP designs incorporating a deliberate sequence of events and being developed for more novice participants; and the provision of feedback by instructor personnel.

Differences between the SST programs were differences in choice between elements of behaviorism and constructivism. The differences in emphasis were: procedural skills versus cognitive skills; mastery versus experiential learning; feedback focused on actions versus processes; and linear versus non-linear TSP development processes. Both constructivism and behaviorism elements were used, but behaviorism was used to a greater extent overall. As suggested by Shlechter and Finley (in preparation), use of constructivism was greatest in COBRAS where it nearly equaled use of the behaviorism approach.

Two questions were suggested earlier in this report:

- Were the SST TSP instructional design elements intentionally selected from both the constructivism and behaviorism/SAT frameworks based on a comparison of their elements?
- Did the actual use of instructional design elements really reflect both instructional theories, whether intentional or not?

Based on discussions with the key developers, the answer to the first question is, "No." All of the persons interviewed stated that they had used, as their foundation, the behaviorism/SAT procedures in TRADOC Regulation 350-70 (DA, 1995). The constructivism approach was not consciously addressed as such.

The design elements actually used, however, based again on discussions with key developers, were based on their considerable experience combined with a very close examination of the training requirements and their operational contexts (e.g., brigade-level staff planning tasks as opposed to platoon-level combat execution tasks). Changes described in SST reports to the TSP design and development procedures (e.g., Campbell & Deter, 1997; Ford & Campbell, 1997; Shlechter & Finley [in preparation]) were the results of these examinations. The answer to the second question, then, is, "Yes."

Overall, it appears that ARI's SST R&D programs demonstrate the approach of modifying instructional design procedures based on a close examination of the training requirements and operational contexts if prescribed design procedures do not seem entirely adequate or appropriate for addressing the requirements. The prescribed procedures were, in this case, those of behaviorism/SAT as covered in TRADOC Regulation 350-70 (DA, 1995). The need to modify or enhance these procedures became increasingly evident as attention began to focus more on the question: What are the command and staff tasks, and the demands of that environment? These tasks and demands had not yet been well defined by the Army. They were also understood to usually have a dominant cognitive component. Constructivism has been argued to be better suited to tasks having larger cognitive components. The history of behaviorism, in contrast, is that it was developed largely through examination of tasks that were more procedural and execution-based and/or, whatever the nature of the task, at least these were the components of the task receiving the most attention.

Behaviorism, and its implementation through SAT, has served the Army very well in assuring development of effective training programs for perhaps the majority of training requirements. The ARI's SST programs, however, were R&D. As such, behaviorism/SAT was not assumed to necessarily satisfy all aspects of the training requirements being addressed.

Rather, ARI adopted a utilitarian stance with regard to instructional theory and application. The ARI SST TSP design approach evolved as seemed best suited for addressing all components of specific training requirements - behavioral and cognitive - rather than adhering strictly to the behaviorism/SAT approach. The result, from the perspective of alternative instructional theories, confirms the contention of Shlechter and Finley (in preparation) that the SST approaches can be described as hybrid applications of the constructivism and behaviorism instructional theories.

Needs for Further Information and Research

Interviews provided the information regarding information and research needs. These needs can be grouped into the areas of: further developing the SST development model; analyses to address information needs; and research on training transfer strategies, methods, and techniques.

SST Development Model

Issues discussed in the Results section covering the SST development model concerned instructional design and implementation, and matching training participant skill levels to simulation capabilities. In SST TSP development there is design of the scenario and then its implementation through simulation software. The design issue concerned the question of: Where is it best to apply instructional design elements drawn from which alternative instructional theories? The development issue concerned the question of: How to gain greater and more flexible control of the TSP scenarios as implemented by simulation software?

At least partial answers to the first question have been afforded by the findings regarding constructivism and behaviorism described above, and suggested by the work of Ross and Pierce (draft 1998). Further answers could probably be obtained through comparative analyses of different instructional concepts and training requirement descriptions. The goal would be to develop schema(ta) regarding appropriate design element applications. Instructional programs resulting from trial use of the schema(ta) could then be evaluated for their effectiveness and efficiency. Answers to the second question, may, upon investigation, be found to already exist. If not, then perhaps software technology has already or will soon be advanced to the point where developing such control capabilities is both technically and economically feasible.

Addressing the issue of matching training participant skill levels to simulation capabilities may fall into two types of efforts: training development and management guidelines. If the answer to an earlier question, "To what extent might more extensive use of inexpensive small group exercises...prepare soldiers to then receive maximum training benefits from a BBS exercise?" is, "They could help substantially," then effort might be well expended to develop additional exercises. Training management guidelines would then be needed to assure that these exercises are used when needed to sustain skills and to develop "gate skills."

Analyses to Address Information Needs

The conduct of FEAs, or needs analyses, was suggested by the CORs to provide information useful for large-scale SST planning and for identifying tasks constituting minimum essential skill sets. Needs to plan for the future of SST as a part of the Army training system led to the recommendation that FEAs be conducted to provide a foundation for an Army SST Master Plan. This master plan will be discussed in more detail later.

Needs to maximize training benefits while minimizing training costs led to discussions of whether there may exist some minimum sets of essential task skills that can be acquired and then sustained over time that would meet particular operational needs (e.g., such a set of skills for an armor unit). This could be considered an extension of the "critical task" concept as used in the conduct of task training analyses. In the latter case, the designation of "critical" is largely a judgment call and it is usually a rather independent one for each individual task. As an alternative to that approach, FEAs were suggested to identify sets of tasks based on an examination of operational requirements. If such sets do exist and if recurring training focused largely on these tasks is found to meet operational needs under acceptable conditions, then perhaps training effectiveness would be enhanced and training costs reduced. An exploration of this concept, at least, appears to be well worth the effort.

Research on Training Transfer Strategies, Methods, and Techniques

Enhancing positive transfer of training to meet operational requirements is clearly in the interests of the Army if it can be done within reasonable cost constraints. On the other hand, ensuring that there is at least some positive transfer of training is not only desirable, it is necessary. Three areas were described as directly relevant to these training transfer concerns: the nesting concept; adaptive thinking; and training bridges. The nesting concept is currently used in the design of SST TSPs; the question asked here was, To what extent should this concept continue to be used exclusively or, rather, should more variety be introduced? To the extent new SST TSPs are developed, the answer to this question will be especially important.

The other two areas appear to be ones which, if found to be feasible and successful, could also be translated into training methods and techniques. If the translations could be accomplished within reasonable cost constraints then such investments on the part of the Army may be desirable or necessary, depending on whether the outcome would be enhancement or assurance of positive transfer.

A fourth area discussed under the Research heading was training measurement. Good measurement, automated if possible, is key to gaining information in many areas, of which training is just one. Any efforts resulting in measures and measurement techniques providing better and more useful information would be well worth the expenditure.

Planning and Logistical Requirements for Integrating SST into the Army's Training System

The general needs for SST R&D and the resultant TSPs were described in the Background section. As a part of the Results section dealing with the proposed master plan, logistics system, and policy, a more specific and up-to-date background was provided. Here, benefits to the Army resulting from use of the SST TSPs were described. Also described were cautions that these benefits would not continue without support and sustainment of SST as a part of the Army's training system. Several problems were presented that cannot be avoided or rectified without such support and sustainment.

Once the U.S. Army decides that a focused effort of any significant scope will be made to address any particular need, various planning and other documents are developed and staffed. In the hope that such a decision will be made with regard to SST and its TSPs, an Army Master Plan has been proposed for consideration and an outline of suggested contents presented. In addition, an SST logistics system has been proposed as a means for providing the needed SST support and sustainment. Beginning with a general definition of logistics, the system's purpose, participants, functions, and one operating principle were outlined and discussed.

The U.S. Army needs effective and efficient training resources. Simulators and simulations offer the potential for enormous training benefits. But, if they are not used properly in an appropriately structured manner, then they can actually become a negative resource - not a positive one. Therefore, we strongly recommend that a decision be made to begin a focused effort to support and sustain SST in the U.S. Army.

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LIST OF ACRONYMS

AAR	After Action Review
AFRU	Armored Forces Research Unit
AFT3	Assessment of Force XXI Training Tools and Techniques
ARI	Army Research Institute for the Behavioral and Social Sciences
ARTEP	Army Training and Evaluation Plan
ARTEP MTP	Army Training and Evaluation Plan Mission Training Plans
BBS	Brigade/Battalion Battle Simulation
BDE	Brigade
CATS	Combined Arms Training Strategy
CBS	Corps Battle Simulation
CCTT	Close Combat Tactical Trainer
CITT	Commanders' Integrated Training Tool
CLS	Contract Logistics Support
COBRAS	Combined Arms Operations at Brigade Level, Realistically Achieved through Simulation
COR	Contracting Officer's Representative
CS	Combat Support
CSS	Combat Service Support
CTC	Combat Training Center
c-w-r	Crawl-Walk-Run
DA	Department of the Army
FAOAC	Field Artillery Officer Advanced Course
FASTTRAIN	Force XXI Training Methods and Strategies
FEA	Front End Analysis
FY	Fiscal Year
ISD	Instructional Systems Development
JRTC	Joint Readiness Training Center
JSIMS	Joint Simulation System
LD	Line of Departure
METT-T	Mission, Enemy, Terrain, Troops, and Time Available
MTP	Mission Training Plan
NCO	Non-Commissioned Officer
NET	New Equipment Training
NSC	National Simulation Center
NTC	National Training Center
O/C	Observer/Controller
R&D	Research and Development

SASO	Stability and Support Operations
SAT	Systems Approach to Training
SGT	Staff Group Trainer
SIMBART	Simulation-Based Mounted Brigade Training Program
SIMNET	Simulation Network
SIMUTA	Simulation-based Multi-echelon Training Program for Armor Units
SIMUTA-B	Simulation-based Multi-echelon Training Program for Armor Units - Battalion Exercise Expansion
SIMUTA-D	Simulation-based Multi-echelon Training Program for Armor Units - Digital
SOP	Standard Operating Procedure
SP	Start Point
SST	Simulation-based Structured Training
STRONGARM	Strategies for Training and Assessing Armor Commanders' Performance with Devices and Simulations
STRUCCTT	Structured Training for Units in the Close Combat Tactical Trainer
STX	Situational Training Exercise
TADSS	Training Aids, Devices, Simulators, and Simulations
TRADOC	U.S. Army Training and Doctrine Command
TSP	Training Support Package
VTP	Virtual Training Program
WARSIM 2000	Warfighter Simulation 2000

APPENDIX A

Contractor Questionnaire

QUESTIONNAIRE FOR KEY MEMBERS OF
THE VTP AND COBRAS INSTRUCTIONAL DESIGN TEAMS
PT Number 60-21

DATA REQUIRED BY THE PRIVACY ACT OF 1974

AUTHORITY: Title 10, USC, Sec 2358.

PURPOSE: As you know, the Armored Forces Research Unit (AFRU) has been deeply involved during the last five years in the research and development of structured simulation-based training programs. Since you have had a key role in the development of these programs, you may then be able to provide us with information from those provided in the published reports concerning their instructional design and the lessons learned from them

The data collected from this form are to be used for **research purposes only. Also, the data will not be used to evaluate the effectiveness of the developed programs nor the associated published reports.**

TIME INVOLVED: It should take you less than 20 minutes to complete this questionnaire. You will have the opportunity **to elaborate** upon some of your answers during the interview phase of this data-collection effort, which should take approximately 40 minutes to complete. Hence, this data collection should take approximately an hour of your time.

DISCLOSURE: Your participation in this research is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of the research, but there will be no effect on individuals for not providing all or any part of the information requested. This page will be removed from the remainder of the questionnaire before responses are examined so that your input will not be identified when the data are analyzed.

I. BACKGROUND ITEMS.

1. Prior to working on the AFRU's R & D efforts to develop and field structured simulation-based training programs, you have been: (You may circle more than one alternative.)
   a. a student/trainee in a military instructional program.
   b. a member of a military instructional team.
   c. an instructional designer.
   d. a member of a program's evaluation team.
   e. a student/trainee in a civilian instructional program.
   f. something other than the roles described above.
   g. none of the above as this is my first experience with a structured training program.

2. How many total years have you been involved with the ARFU's efforts to develop and field structured simulation-based training programs?
   a. five or more years. b. two - four years. c. one year or less.

3. You were/are involved in which of the following efforts? (You may circle more than one alternative.)
   a. SIMUTA/VTP b. SIMBART c. SIMUTA-D
   d. COBRAS e. SGT f. STRUCCTT g. others____________

4. Check your activity(ies) for each program. You may check one or more than one of these activities per program. Checking N/A means that you did not work on the program.

	VTP	SIMBART	SIMUTA-D	COBRAS	SGT	STRUCCTT
Instructional designer	____	____	____	____	____	____
Evaluator	____	____	____	____	____	____
Supervisor	____	____	____	____	____	____
Other	____	____	____	____	____	____
N/A	____	____	____	____	____	____

5. For each program, check the blank which best reflects your answer to the following question. *How well did your professional or educational experiences prior to working on the AFRU's structured simulation-based training program prepare you for the activities checked in item 4?* Checking N/A means that you did not work on this program.

	VTP	SIMBART	SIMUTA-D	COBRAS	SGT	STRUCCTT
Extremely well	____	____	____	____	____	____
Well	____	____	____	____	____	____
Poorly	____	____	____	____	____	____
Not at all	____	____	____	____	____	____
N/A	____	____	____	____	____	____

6. For each program, check the blank which best reflects your answer to the following question. *How similar are ARFU's instructional programs to those programs that you either previously worked on or took as a student/trainee?* Checking N/A means that you did not work on this program.

	VTP	SIMBART	SIMUTA-D	COBRAS	SGT	STRUCCTT
Extremely similar	____	____	____	____	____	____
Moderately similar	____	____	____	____	____	____
Moderately different	____	____	____	____	____	____
Extremely different	____	____	____	____	____	____
N/A	____	____	____	____	____	____

Please answer this questionnaire's items in relation to those programs which have you helped to design or develop. Separate response areas are provided for the VTP (part A) and COBRAS (part B) in each of the following questionnaire sections. Feel free to ask any question which you may have concerning the materials presented in this questionnaire.

II. OVERVIEW ITEMS. More than one alternative may be circled for each item.

A. The VTP SET of Instructional Programs - SIMUTA, SIMUTA-D, SIMBART, and STRUCCTT.

1. These programs are most suitable for training units whose personnel are at a(n):
   a. basic level/novice of armor expertise.
   b. intermediate level of armor expertise.
   c. advanced/expert level of armor expertise.

2. The basis(es) of the programs' instructional design was/were:
   a. previous SST training programs.
   b. previous non-SST military training programs.
   c. previous civilian training programs.
   d. military training doctrine.
   e. the instructional design literature.
   f. factors other than those cited in alternatives a-g.

3. Developing these programs involved overcoming difficulties or constraints:
   a. not foreseen at the program's on-set.
   b. inherent in working with people with diverse backgrounds.
   c. associated with developing a novel set of instructional materials.
   d. associated with the military culture.
   e. other difficulties or constraints than those delineated in Alternatives a-e.

4. The developmental team should have spent more time on:
   a. analyzing the pre-training skills of prospective training participants.
   b. determining the instructional media.
   c. determining the performance objectives.
   d. discussing issues with the instructional personnel.
   e. discussing issues with prospective training participants.
   f. doing something other than listed in Alternatives a-e.
   g. doing none of the above; the right amount of time was spent on the different developmental activities.

5. Applying your own definition of "success" to those VTP programs you have been involved in, you would put the success rate of these programs for accomplishing their instructional goals at:

	SIMUTA	SIMUTA-D	SIMBART	STRUCCTT
Greater than 90%.	____	____	____	____
Between 75% and 89%.	____	____	____	____
Between 49% and 74%.	____	____	____	____
Between 48% and 25%	____	____	____	____
Between 24% and 10%.	____	____	____	____
Less than 10%	____	____	____	____
An undetermined rate.	____	____	____	____

B. The COBRAS SET of Instructional Programs - COBRAS I - III and SGT.

1. These programs are most suitable for training units whose personnel are at a(n):
   a. basic level/novice of armor expertise.
   b. intermediate level of armor expertise.
   c. advanced/expert level of armor expertise.

2. The basis(es) of the programs' instructional design was/were:
   a. previous SST training programs.
   b. previous non-SST military training programs.
   c. previous civilian training programs.
   d. military training doctrine.
   e. the instructional design literature.
   f. factors other than those cited in alternatives a-g.

3. Developing these programs involved overcoming difficulties or constraints:
   a. not foreseen at the program's on-set.
   b. inherent in working with people with diverse backgrounds.
   c. associated with developing a novel set of instructional materials.
   d. associated with the military culture.
   e. other difficulties or constraints than those delineated in Alternatives a-e.

4. The developmental team should have spent more time on:
   a. analyzing the pre-training skills of prospective training participants.
   b. determining the instructional media.
   c. determining the performance objectives.
   d. discussing issues with the instructional personnel.
   e. discussing issues with prospective training participants.
   f. doing something other than listed in Alternatives a-e.
   g. doing none of the above; the right amount of time was spent on the different developmental activities.

5. Applying your own definition of "success" to those COBRAS programs you have been involved in, you would put the success rate of these programs for accomplishing their instructional goals at:

	COBRAS I	COBRAS II	COBRAS III	SGT
Greater than 90%.	____	____	____	____
Between 75% and 89%.	____	____	____	____
Between 49% and 74%.	____	____	____	____
Between 48% and 25%	____	____	____	____
Between 24% and 10%.	____	____	____	____
Less than 10%	____	____	____	____
An undetermined rate.	____	____	____	____

III. CONSTRUCTIVISTIC OR BEHAVIORISTIC/SAT ISSUES. Remember, answer these items in relation to those programs which you have helped to design, develop, and/or implement.

The instructional design literature has been embroiled in a controversy concerning Constructivism vs. SAT/Behaviorism. Characteristics of constructivism and the SAT/behaviorism approach are listed below. Answer these items in relation to those programs which you have helped to design, develop, and/or implement. You may find that a particular element of constructivism or behaviorism applies to both the VTP and COBRAS programs, to one of these programs, or to neither of these programs. In any case, select those items which do apply to your program.

A. *The VTP Set of Instructional Programs.* Check elements which represent a **pervasive characteristic** of the different VTP instructional programs.

Elements of Constructivism

____ Training objectives determined by the training participants.

____ Training objectives also emerge as training participants interact with the training materials.

____ Task(s) immerse(s) participants in realistic battlefield conditions for their echelon.

____ Course materials focused on developing a unit's higher order cognitive skills (e.g., its tactical decision-making).

____ Course materials focused on helping participants' develop the skills necessary to fight in new and different battlefield conditions.

____ Instructional program need not contain a standardized set of instructional materials.

____ Instructional program does not contain a particular instructional sequence (e.g., "crawl-walk-run").

____ Instructional materials developed for the more experienced or advanced training participants.

____ Experiential learning is more important than mastery learning.

____ Instructional personnel should refrain from providing performance feedback to the participants as they are executing a table.

____ Student-led AARs.

____ Feedback geared more to the unit processes (e.g., communication among tanks) associated with any particular action (e.g., getting to the LD/SP on time) than to the action itself.

____ A non-linear or spiral progression used in the instructional design process.

The VTP continued:

Elements of SAT/Behaviorism

____ Training objectives determined by the instructional design team.

____ Training objectives determined as an initial part of the design process.

____ Task(s) does not/do not need to immerse training participants in realistic battlefield conditions for their echelon.

____ Course materials focused on developing the unit's procedural-level tactical skills (e.g., executing tactical formations).

____ Course materials focused on helping participants' develop the skills necessary to fight in battlefield conditions which resemble the scenario.

____ Instructional program must contain a standardized set of instructional materials.

____ Instructional program contains a particular instructional sequence (e.g., "crawl-walk-run").

____ Instructional materials developed for the less experienced or novice-level participants.

____ Mastery learning is more important than experiential learning.

____ Instructional personnel should, if needed, provide performance feedback to the participants as they are executing a table.

____ Instructor-led AARs.

____ Feedback geared more to the unit's actions (e.g., getting to the LD/SP on time) than to the processes (e.g., communication among tanks) associated with its action(s).

____ A linear or sequential progression in the instructional design process.

B. *The COBRAS Set of Instructional Programs.* Check elements which represent a **pervasive characteristic** of the different COBRAS instructional programs.

Elements of Constructivism

____ Training objectives determined by the training participants.

____ Training objectives also emerge as training participants interact with the training materials.

____ Task(s) immerse(s) participants in realistic battlefield conditions for their echelon.

____ Course materials focused on developing a unit's higher order cognitive skills (e.g., its tactical decision-making).

____ Course materials focused on helping participants' develop the skills necessary to fight in new and different battlefield conditions.

____ Instructional program need not contain a standardized set of instructional materials.

____ Instructional program does not contain a particular instructional sequence (e.g., "crawl-walk-run").

____ Instructional materials developed for the more experienced or advanced training participants.

____ Experiential learning is more important than mastery learning.

____ Instructional personnel should refrain from providing performance feedback to the participants as they are executing a table.

____ Student-led AARs.

____ Feedback geared more to the unit processes (e.g., communication among tanks) associated with any particular action (e.g., getting to the LD/SP on time) than to the action itself.

____ A non-linear or spiral progression used in the instructional design process.

Elements of SAT/Behaviorism

____ Training objectives determined by the instructional design team.

____ Training objectives determined as an initial part of the design process.

____ Task(s) does not/do not need to immerse training participants in realistic battlefield conditions for their echelon.

____ Course materials focused on developing the unit's procedural-level tactical skills (e.g., executing tactical formations).

____ Course materials focused on helping participants' develop the skills necessary to fight in battlefield conditions which resemble the scenario.

B. COBRAS continued:

____ Instructional program must contain a standardized set of instructional materials.

____ Instructional program contains a particular instructional sequence (e.g., "crawl-walk-run").

____ Instructional materials developed for the less experienced or novice-level participants.

____ Mastery learning is more important than experiential learning.

____ Instructional personnel should, if needed, provide performance feedback to the participants as they are executing a table.

____ Instructor-led AARs.

____ Feedback geared more to the unit's actions (e.g., getting to the LD/SP on time) than to the processes (e.g., communication among tanks) associated with its action(s).

____ A linear or sequential progression in the instructional design process.

APPENDIX B

COR Structured Interview Forms

COR Structured Interview Form

1. How did your professional or educational experience(s) prepare you for the described roles?

We are now going to ask you some questions concerning the **(development or implementation)** of the cited structured training programs.

2. As you see it, what are the two or three most important instructional goals of these structured training programs?

3. Do you believe that these goals have been realized? If so, then how? If not, then why not?

4. As you see it, what are the three most problematic aspects of the structured training program? State a reason for each answer.

5. How was/were the structured training programs similar to those that you have previously been associated with as an instructional designer, evaluator, instructor and/or trainee?

6. How was/were the structured training programs similar to those that you have previously been associated with as an instructional designer, evaluator, instructor and/or trainee?

7. What is/are the basis (es) for your answers to the last two questions? (such as previous experience with the SAT processes or coursework)

8. According to your experience, what were the three most notable problems that Army personnel had with instituting the implemented structured training program(s)? Also state the reason(s) for the problem.

9. What additional instructional or management tools are needed to help Army personnel sustain the implemented structured training programs?

The final set of items deals with an assortment of issues.

10. What are the two or three most salient contributions that the structured training programs have made to the military training community?

11. What is/are to you the most gratifying aspect(s) of the structured training programs?

12. What two or three things should have been done differently in developing and/or implementing these programs?

13. Please cite two or three research and development efforts that are now needed. State a reason for each need.

COR STRUCTURED INTERVIEW QUESTIONS

♦ How is "structured training" unique?:

(1) Within the domain of the instructional systems development (ISD), or systems approach to training (SAT), approaches, what is unique with regard to "structured training" in terms of either method or product?

(2) Which of these "unique" aspects do you consider to be truly unique?

(3) Which of these "unique" aspects do you consider to relate to or derive from other front end analysis techniques used for other purposes?

(4) Please describe each of the latter with references to the extent possible.

♦ The world of training research and development has moved from a behaviorist viewpoint which considers only the stimulus and response (S-R) to cognitive one which includes the intervening cognition (S-O-R). The focus of your, ARI's, work on structured training has similarly evolved from a strictly behavioral psychology position to one that encompasses cognitive psychology. The focus has also changed from one that is centered on the platoon to one that encompasses several echelons (vertical focus) and combined arms (horizontal focus), including staffs. In summary, changes in the focus of structured training research include: (1) Moving from strictly behavioral towards inclusion of cognitive considerations, and (2) Moving from single units only towards inclusion of vertical and horizontal players and their relationships. Please discuss the bases of these changes. Were they:

(1) Intentional and based on a knowledge of the overall movements of psychological research? If yes, what research articles and other sources of information?

(2) The result of a common zeitgeist, the articulation of which you shared with others? Who were these "others"? If a zeitgeist, how long have these "cognitive psychology" views been around and how common were they?

(3) Primarily a response to directions and requests from customers/sponsors.

♦ What further research is needed on structured training as it is exemplified by the already developed TSPs?

♦ How might the concept of structured training and/or the development methodology be further developed and/or expanded?

♦ To what other training needs might structured training be usefully applied? How should the development methodology be modified to handle these needs?

♦ Do any of the needs for additional research derive from or relate to any current movements/evolutions in:

(1) Psychology/training research?

(2) Military doctrine?

(3) Technology?

Please discuss.

COR INTERVIEW ITEMS

The first two interview items deal with additional questions concerning the constructivistic and ISD aspects of these programs. Remember -

For Constructivism:

The instructional emphasis is on: (a) authentic instructional conditions; (b) instructional objectives emerging from decisions made by the training participants; (c) training participants' developing an understanding of the principles of tactics; and (d) student-led AARs.

For SAT:

The instructional emphasis is on: (a) instructional objectives being determined before training is given; (b) instructional objectives being fulcra for developing the instructional materials (c) training participants' being able to execute tactical actions, and (d) instructor-led AARs.

1. Did the developmental process employed for the **COBRAS** set of programs (exclude the SGT set of programs) more closely resemble the practices of constructivism or traditional ISD? (You can answer by saying neither.) Provide a short rationale for your answer.

2. Did the developmental process employed for the **SGT** set of programs more closely resemble the practices of constructivism or traditional ISD? (You can answer by saying neither.) Provide a short rationale for your answer.

Now, aside from the issues of constructivism and ISD behaviorism:

3. In comparing the **COBRAS** and **SGT** sets of programs:

   a. What are the two or three most striking <u>similarities</u> between/among these programs?

   b. What are the two or three most striking <u>differences</u> between/among these programs?

4. What to you, personally, are the most gratifying aspects of the structured training programs?

5. What additional R&D efforts are now needed to improve these programs?

APPENDIX C

Contractor Structured Interview Form

INTERVIEW QUESTIONS FOR KEY MEMBERS OF
THE VTP AND COBRAS INSTRUCTIONAL DESIGN TEAMS
PT Number 60-21

Please answer these interview questions in relation to those programs which you have helped to design, develop, and/or implement. You were/are involved in: SIMUTA/VTP, SIMBART, SIMUTA-D, COBRAS, SGT, STRUCCTT, and/or others?

A. Follow-up questions on selected questionnaire items. Ask the participants to provide short explanations for their responses to those questionnaire items selected by the interviewers.

B. Additional questions.

1. **(For those who have been associated with VTP and COBRAS and STRUCCTT.)** What are the two or three most striking <u>similarities</u> between/among the VTP, COBRAS, and/or STRUCCTT instructional programs?

2. **(For those who have been associated with VTP and COBRAS and STRUCCTT.)** What are the two or three most striking <u>differences</u> between/among the VTP, COBRAS, and/or STRUCCTT instructional programs?

3. What were/are the two or three most important instructional goals of these structured training programs?

4. What are the two or three most salient "lessons learned" from these structured training programs?

5. What are the two or three most salient contributions that the structured training programs have made to the military training community?

6. What is/are the most gratifying aspect(s) of the structured training programs?

7. What else should have been done in the development and implementation of these instructional programs?

8. What additional R & D efforts are now needed to improve this (these) programs?

APPENDIX D

Detailed Breakdown of Instructional Element Selections Made by the Differentiators

Table D-1 describes the background characteristics of two groups, the differentiators and the non-differentiators. Those who made differential selections of instructional design elements between the programs they had worked on will be called the "differentiators." Those who did not will be called the "non-differentiators." Table F-2 will repeat the detailed breakouts and sums regarding selections of instructional design elements found earlier in Table 4 - but will display only the responses of the six respondents out of the 11 who worked on more than one program and were differentiators in their selections as well.

Backgrounds of the Differentiators and the Non-Differentiators

The background data from the questionnaires were examined in a search for items where the frequency of responses was distinctly different for the differentiators when compared to the non-differentiators. Data for three items showing such a difference are presented in Table D-1. While the first item in the table, "Studt/trainee in a military instruct prog," met the criterion of difference, we do not know if this has any explanation useful for our question here. The other two items, however, "instructional designer" and "evaluator" do appear useful. That is, it appears reasonable to suggest that having even more prior and SST program experience in these two areas, design and evaluation, might make the respondent more knowledgeable about and sensitive to differences between constructivism and behaviorism/SAT elements in instructional design and execution - whether or not they are familiar with the labels for these concepts.

Table D-1. Differentiators compared to Non-Differentiators with regard to selected prior training-related experiences and similar SST program activities.

	FREQUENCIES AND PROPORTIONS			
	DIFFERENTIATORS N = 6		NON-DIFFERENTIATORS N = 5	
EXPERIENCE/ ACTIVITIES	PRIOR EXPERIENCE	SST ACTIVITIES	PRIOR EXPERIENCE	SST ACTIVITIES
Studt/trainee in a military instruct prog	2 **(.33)**	-	4 **(.80)**	-
Instructional designer	5 **(.83)**	6 **(1.00)**	3 **(.60)**	4 **(.80)**
Evaluator	4 **(.67)**	5 **(.83)**	2 **(.40)**	2 **(.40)**

Selections Made by the Differentiators

Table D-2 will display the responses of only the six respondents out of the 11 who worked on more than one program and were also differentiators in their selection of constructivism and behaviorism/SAT elements for the two or three program sets on which they had worked. The respondent Ns are in every case quite small (Ns = 6, 4, and 2). Despite this, the data were judged to be of interest because: (1) the indication from the background data (Table D-1) that these persons may have been differentiating between program sets on the basis of greater knowledge and/or experience with instructional design and evaluation, and (2) any differences from and/or similarities with the data presented for all 15 respondents (Tables 4) may serve to either substantiate the findings provided by those data or, instead, call them into question. It can be stated at the outset that the data presented in Table 9 serves to substantiate the earlier findings. Overall, the findings are the same. Where there are differences, they are ones that accentuate the earlier findings in the anticipated directions.

Table D-2 presents the details and a summary of the differentiators' responses. The accentuation of the differences between the VTP/STRUCCTT and COBRAS programs can be noted by describing differences in the proportions of constructivism and behaviorism/SAT elements selected earlier in Table 4 as compared to Table D-2. In Table 4, the difference between the proportions for VTP/STRUCCTT was .69 - .41 = .28. In Table D-2, the difference is greater, .78 - .35 = .43. The appearance in Table 4 that behaviorism/SAT was used to a greater extent in the VTP/STRUCCTT is sustained in Table D-2. Although there is a change for COBRAS, it is quite small and given the N, little can be said other than that constructivism again appeared to be applied to a greater extent in COBRAS than in VTP/STRUCCTT.

Table D-2. Frequencies and proportions of selections made by the differentiators across the VTP/STRUCCTT (VTP/STR), SGT, and COBRAS sets of programs regarding each of the constructivism and SAT/behaviorism elements.

SELECTION FREQUENCIES AND PROPORTIONS PER SST PROGRAM SET FOR THE DIFFERENTIATORS								
	CONSTRUCTIVISM ELEMENTS	VTP/STR N = 6	SGT N = 4	COBRAS N = 2	SAT/BEHAVIORISM ELEMENTS	VTP/STR N = 6	SGT N = 4	COBRAS N = 2
1	Training objectives determined by training participants	2 (.33)	2 (.50)	2 (1.00)	Training objectives determined by design team	6 (1.00)	3 (.75)	2 (1.00)
2	Training objectives also emerge with interaction	3 (.50)	2 (.50)	2 (1.00)	Training objectives determined early in design	6 (1.00)	4 (1.00)	2 (1.00)
3	Tasks immersed in real battlefield conditions	6 (1.00)	3 (.75)	2 (1.00)	Tasks do not need immersion in real conditions	0 (.00)	1 (.25)	0 (.00)
4	Course materials focus on cognitive skills	1 (.17)	[illegible] (.75)	[illegible] (1.00)	Course materials focus on procedural skills	[illegible] (1.00)	1 (.25)	1 (.50)
5	Course materials focus on new/different conditions	2 (.33)	2 (.50)	1 (.50)	Course materials focus on common scenarios	6 (1.00)	3 (.75)	1 (.50)
6	Instructional program need not have standard materials	1 (.17)	0 (.00)	0 (.00)	Instructional program must contain standard materials	6 (1.00)	4 (1.00)	2 (1.00)
7	Instructional prog need not have a particular sequence	1 (.17)	0 (.00)	0 (.00)	Instructional program contains a particular sequence	5 (.83)	4 (1.00)	2 (1.00)
8	Instructional materials dev for more advan participants	1 (.17)	0 (.00)	1 (.50)	Instructional materials dev for more novice participants	5 (.83)	4 (1.00)	1 (.50)
9	Experiential learning more important than mastery	3 (.50)	2 (.50)	[illegible] (1.00)	Mastery more important than experiential learning	[illegible] (.67)	[illegible] (.50)	0 (.00)
10	Instr personnel sh/refrain from gvng feedbk in exercs	2 (.33)	1 (.25)	0 (.00)	Instr personl should, if needed, give feedback in exercise	5 (.83)	2 (.50)	2 (1.00)
11	Student-led AARs	0 (.00)	[illegible] (.75)	[illegible] (1.00)	Instructor-led AARs	[illegible] (.83)	1 (.25)	1 (.50)
12	Feedback geared to process rather than actions	3 (.50)	[illegible] (.50)	[illegible] (1.00)	Feedback geared to actions rather than process	[illegible] (.67)	1 (.25)	1 (.50)
13	Non-linear or spiral instructional design process	2 (.33)	0 (.00)	[illegible] (1.00)	Linear or sequential instructional design process	[illegible] (.50)	[illegible] (.50)	0 (.00)
∑ and proportion (∑ ÷ Nx13)		27 (.35)	20 (.38)	18 (.69)	∑ and proportion (∑ ÷ Nx13)	61 (.78)	32 (.62)	15 (.58)